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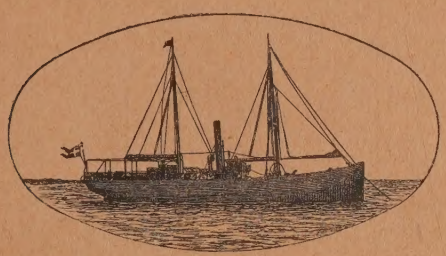

XIII.

1903 and 1904.

By

C. G. Joh. Petersen,
Ph. D.

Translated from „Fiskeri-Beretning for 1904—05".

Copenhagen.
Centraltrykkeriet.
1906.

From

The Danish Biological Station.

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Eggs and Young of Fishes in the Danish Waters.

(Investigations during 1904 and earlier years.)

By **Andreas Otterstrøm.**

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Introduction.

It is about 14 years since the Director of the Biological Station began investigations on the pelagic life in Danish waters. The method of the investigations and the material were not then so perfect as they are now. The

want of a steamer especially was greatly felt, as the vessel at the disposal of the Biological Station at that time, a transport-boat of the fleet called »Stationen«, though well-fitted up with laboratory, well and store-room, had to have a special steamer of the navy to tow it each time it was moved.

On account of these difficulties in changing from place to place, the Director in *the spring of 1901* decided, to moor »Stationen« in *Fænø Sound* in the Little Belt. The current runs so strongly there, that townetting can be carried on *pelagically* by merely hanging the net over the side from the anchored ship, and the surface-water is usually of a sufficiently high salinity to float the pelagic eggs and newly hatched larvæ.

From April 1891 until September 1892 the investigations were being carried on in Fænø Sound. They furnished a rich collection of pelagic organisms, as also of the eggs and young of fishes, so that in 1892 the Director was able to publish a review over the pelagic life in Fænø Sound during the twelve months of the year (Biol. Stat. Beretn. III).

On the conclusion of the 1891—92 investigations in Fænø Sound, the Biological Station was engaged in other directions for a number of years, but in 1899 the Director again took up the interrupted investigations on the pelagic eggs and young of fishes, with the special object in view of carrying out *simultaneous observations at different places in the Danish waters.* The method of proceedure had therefore to be different from that used in 1891—92. The Biological Station was not yet in possession of a steamer, and was thus unable to make the many necessary collections by itself. Other means had therefore to be employed, and most of the gatherings were taken from a number of lightships, which were specially suited for the purpose on account of their proximity to deep channels. *Vertical hauls* with the *pelagic net* were taken twice monthly and the gatherings sent in to the Biological Station. When these collections had been continued for two years, April 1899—April 1901, they were brought to an end and the material was then worked out. The results are published in »*De danske Farvandes Plankton i Aarene 1898—1901,* I—II« (D. kgl. Vidensk. Selsk. Skrifter, 6. Række, naturvidensk. og math. Afd. XIII, 3.). The first portion, written by the Director, contains a section on fish eggs and young, based on the collections mentioned. The number of eggs and young in each gathering is given in the form of lists, the determinations being added so far as they could be made.

In the spring of 1902 Fænø Sound was again chosen as the mooring-place for »Stationen«, but as the Biological Station now had a steamer at its disposal, the investigations were extended so as to embrace, not only the neighbouring portions of the Little Belt but the other Danish waters also. The methods were also improved; especially was this the case with an excellent apparatus for the capture of fish young, constructed by the Director and described under the name of *Petersen's young-fish-trawl* by Dr. Johs. Schmidt in »Fiskeriundersøgelser ved Island og Færøerne i Sommeren 1903« (Skrifter udgivne af Kommissionen for Havundersøgelser Nr. I).

From March 4th to the 22nd of May 1902, »Stationen« was at Fænø Sound. »Bobbin« tow-nets were employed, hung from the boat's side in the current and usually emptied and hung out again several times in the day. Now

and then the »Sallingsund« made short or long excursions, using on those occasions the young-fish trawl.

In 1903 and especially in 1904 very comprehensive investigations of the pelagic fish eggs and young were made according to plans drawn up by the Director and carried out under his direction by the author. In 1903 the *young-fish trawl* was used only to a limited extent, the *pelagic tow-net* being alone employed at many stations, and as the larger specimens of the young fishes are but seldom taken in the pelagic net, we cannot obtain a complete picture of the kind and number of young present, when only this apparatus is used. On the other hand all sizes of the pelagic young, at any rate of the species found in Danish waters, can be taken by the young-fish trawl. It is better therefore to use only the hauls with the young-fish trawl as basis for a view over the occurrence of the fish young. The eggs are therefore investigated by means of the pelagic townet, the young by means of the young-fish trawl.

The Tables 1—3 (see p. 72—84) have been drawn up on this principle; for 1903 only a summary of the hauls in which pelagic young were taken is given (Tab. 3 A), for 1904 both a special table (Tab. 1) and also summary tables showing the hauls of pelagic eggs (Tab. 2) and of young fishes (Tab 3 B).

The stations where surface and intermediate hauls were made with the pelagic tow-net and the young-fish trawl are noted in Tab. 1 from the Journal for 1904. For each station is given the *date, place and hydrographical conditions, then the eggs taken, with the pelagic net and the young taken with the young-fish trawl.*

The stations are placed in *chronological order for each of the regions** into which the Danish waters are divided.

The place is determined by data showing the bearings: distance in nautical miles and depth in fathoms (1 fathom = ca. 2 meters). The *water-samples* were taken by means of a water-sampler and the *salinities* determined by areometer on board.

The hauls made with the *pelagic net*** were partly vertical, partly horizontal. The vertical hauls were always taken to the surface, the tables show from what depths. In order to take the pelagic eggs near the bottom we used the "pelagic net on a pole", that is: the net was fastened to the top of a pole a

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* The boundaries between the regions are shown on Chart I p. 24; they are as follows:

Line	Hanstholm—The Naze	separates	North Sea and Skager Rak,
»	Skaw lightship—Marstrand	»	Skager Rak and Kattegat,
»	Elsinore—Helsinborg	»	Kattegat and the Sound.
»	South end of Samsø—Refsnæs	»	Kattegat and Great Belt,
»	Ashoved—Endelave—South end of Samsø	»	Kattegat and Little Belt,
»	South end of Samsø- Nord-east point of Funen	»	Great Belt and Little Belt,
»	Copenhagen—Malmø	»	The Sound and true Baltic,
»	South end of Langeland—Albuen	»	Great Belt and western Baltic,
»	Thorø—Aarø	»	Little Belt and western Baltic,
»	Gedser—Darsserot	»	Western Baltic and true Baltic.

Thyborøn and Hals are the natural boundaries of the Lim Fjord towards the North Sea and the Kattegat.

** Gauze No. 0; opening 90 cm. in diameter. For description, see: "De danske Farvandes Plankton", I, p. 233.

little more than a fathom long. The pole maintains a vertical position in the water by having an iron weight on its lower end with some glass air-balls on the upper. By towing this pole along the bottom in a crowfoot, the net is always about a fathom's distance from the ground. When the tables indicate horizontal hauls with the pelagic net a fathom's distance from the bottom, that always means hauls with the "pelagic net on a pole". The horizontal hauls with the pelagic net are continued to the surface on pulling in. The duration of the haul, given in the table in minutes, is the time occupied in fishing at the depth indicated. In the column for the duration the sign 1 denotes the vertical hauls.

The *pelagic fish eggs* were counted immediately after the haul was made. The numbers are only approximate except in the case of the vertical hauls. The determinations were made on board, sometimes by letting the eggs hatch out, but usually by a rapid microscopic examination. We have therefore not been able to determine every single egg, but have restricted ourselves to noting the species we recognised without too close investigation.

As a matter of fact, our attention has been mostly directed to the capture and determination of the young fishes. The methods for the capture of these have been greatly improved by the Director even during the progress of the investigations. *Petersen's young-fish trawl* has been constantly used and we have made horizontal hauls with it at varying depths. When using it at or near the surface, we fastened an air-bladder on to the upper part at its centre. When using it deeper down, so far as possible at a certain depth below the surface, we made a line fast to the centre of the upper part and tied a buoy to the end of the line. The buoy was thus able to support the trawl and yet remain on the surface when the »Sallingsund« was moving. In this way we know at any rate, that the trawl did not go deeper than the length of the line, in fact scarcely so deep, as the line was towed a little obliquely in the water. We could not use this method however in fishing close to the bottom, as we ran the risk of the trawl touching the ground, and thus of the pelagic catch being covered over and destroyed by bottom-material and larger fish. It was therefore a great gain to the investigations when the Director constructed the so-called *"young-fish trawl on blocks"*. Below each of the poles, to which the body of the trawl is attached, is fastened a block. This is composed of a tin-plate cylinder with a circular disc of wood at each end. The diameter of the wooden discs is ca. 20 cm. and the cylinder has the same height. The blocks are therefore hollow. A hole is bored in each of the discs, so that the water enters the cylinder when the blocks sink under the surface and flows out again as soon as they are brought in. The blocks are fastened to the trawl by passing the poles through the cylinders. The underpart of the trawl can now be be made fast to the poles at any distance great or small above the blocks; even if the trawl is fastened just above the upper edge of the blocks, it can usually be towed over sandy or stoney ground without taking in any bottom-material.

On Tab. 1 is given the approximate depth at which each haul of the young-fish trawl was made. When this depth is noted along with the depth of the station, this means as a rule that the trawl was used on the bottom with the blocks. Hauls on the bottom without blocks on the trawl are only exceptionally

noted in the Table, as the pelagic young were almost always, when the trawl went on the bottom, covered by bottom-material.

All hauls with the young-fish trawl traverse the water-layers to the surface on heaving in, so that, to determine in what depth under the surface the young taken lived, a comparison must be made between the catches at the various depths.

In tabulating the catches of the pelagic young fish* in the various hauls with the young-fish trawl the commonest species are placed first in the 17 vertical columns. Species with pelagic eggs are placed before those with demersal eggs. The column: *Clupea sp.,* includes young from pelagic eggs (*Cl. sprattus*, Sprat) as well as those from demersal eggs (*Cl. harengus*, Herring).

The less common pelagic young are placed in the last column along with the older fishes and the bottom-stages. By older fishes is meant all those considered to be at least one year old; they are marked with* to distinguish them from the younger fish placed in the same column. The bottom-stages given in the Table are distinguished by the addition "bottom-stages".

Tab. 2 summarises the occurrence of the pelagic eggs in 1904. The Table is deduced from Tab. 1 and indicates the species found in each region in each month of the year.

Tab. 3 A and B summarise in a similar manner the occurrence of the pelagic young in 1903 and 1904. The number of young taken is noted for each single species for every month and for each region. The Table likewise gives information concerning the period occupied each month in investigating the pelagic young in each of the regions, as it shows the number of hauls made with the young-fish trawl and the total duration of these hauls. Tab. 3 B is constructed from Tab. 1, and Tab. 3 A from a corresponding (not printed) Table for 1903.

The *international investigations of the sea* began in 1903. So far as Denmark is concerned, there were placed in the hands of *"Kommissionen for Havundersøgelser"*, and a steamer, the *"Thor"*, was placed at the disposal of the investigations. During the summer this steamer has been engaged at Iceland. During the spring and autumn it has worked in the Kattegat, Skager Rak and North Sea. On these cruises Dr. A. C. Johansen has collected pelagic material, which he has kindly worked out for the present report. The stations of the "Thor" are placed alongside those of the "Sallingsund" in the Tables. The investigations were carried out on the same principles and with the same apparatus: pelagic tow-net and Petersen's young-fish trawl, as from the "Sallingsund".

Neighbouring countries have also taken part in the international investigations; and from the German side a report is already to hand: "Eier und Jugendformen der Ostseefische, I. Bericht von E. Ehrenbaum und S. Strodtmann, 1904", in which are described the investigations carried out in 1903 on the pelagic eggs and young of fishes in the *western and true Baltic.* These regions are included in what we have described as the Danish waters, so that a more complete picture of the pelagic life in Danish waters is obtained if we compare the German results with ours.

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* The terms "young" or "young fish" used in this work refer only to the specimens of the first year's or 0 group.

An investigation of young fishes must also embrace the *bottom-stages*. We have therefore not restricted our investigations with the young-fish trawl to the intermediate layers, but have also made numerous hauls *on the bottom* with this trawl, both on the bare ground in deep water and on the *Zostera* and algæ-covered grounds near the coast. The "young-fish trawl on blocks" has often been used on such ground for the capture of the young of the cod, especially where the bottom was stoney. A table giving the results of these investigations, though not printed, has served as the basis for the summaries employed in the special portion of this work to show the occurrence of the bottom-stages of the cod (Tab. A, p. 24) and also of those of the plaice (Tab. G. p. 40).

General Part.

Hydrography.

During our work at sea on the investigations of the pelagic eggs and young of fishes, we have taken data regarding the *hydrography of the place* at each station. Our special aim was to find the boundary between the salt, deeper layer and the less salt, surface layer. Under normal conditions we have always been able to detect such a boundary in the deeper parts of all the regions, from the true Baltic to the Skager Rak, including the latter. The difference between the temperature and especially the salinity at a little distance below and above the boundary is often very great.

It was only when we knew the salinity at the surface and bottom and the boundary mentioned, that we could determine in what depths we wished to fish with the pelagic net and young-fish trawl; and if the hydrographical data at the various stations, given in Tab. 1, is compared with the depth of the haul made at the same place, it will be seen, that we have used our knowledge of the hydrographical conditions for the fisheries work. I may mention one exemple:

D. 27—5—04. S.O. f. Sprogø, 20 fm. (Tab. 1, Great Belt).

0 fm.	— $10._1$ ° C.	— $12._6$ ‰	salinity
10 »	— $10._0$ »	— $15._3$ »	»
15 »	— $7._5$ »	— $29._9$ »	»
20 »	— $7._1$ »	— $29._9$ »	»

We first of all determined the temperature and salinity at the surface and bottom and then at a depth of 10 fathoms. These three determinations showed us, that we were still in the surface water at 10 fathoms. We therefore sank the water-sampler down to 15 fathoms and reached, as can be seen, the salt bottom water. The upper boundary of this must therefore have been at a depth between 10 to 15 fathoms.

We reckoned now that the pelagic eggs would be floating on the surface of the bottom water. This was of sufficient salinity to support them, whereas the great majority would sink down through the surface water, which even at 10 fathoms down, that is, near the boundary to the bottom water, was only $15._3$ ‰.

In order to obtain some pelagic eggs for investigation we fished with the pelagic net at a depth of 15 fathoms. The result was 70 eggs in 5 minutes.

As regards the young fish, we wished to determine what was to the found in the surface water as well as in the bottom. We therefore made two hauls with the young-fish trawl, the buoy attached, and for the first haul let the line of the buoy have a length of 10 fathoms; we thus made sure that the trawl went no deeper than this. The result was 12 young in 30 minutes. We now gave the buoy more line, so that the trawl according to our calculation might fish at a depth of ca. 16 fathoms. The result showed, that we had now reached down to where the young fish were, as we obtained ca. 260 specimens in one haul of 10 minutes. The difference is striking, the first haul as mentioned only giving 12 in 30 minutes.

At most of our stations we were satisfied with fewer determinations of salinity, as we could judge beforehand, from the position of the station, at what depth approximately we should meet with the boundary between the surface and bottom water, a confirmation of our supposition was therefore sufficient. If things turned out differently from what we expected, we put the water-sampler down to a different depth.

As may be judged from the foregoing, our hydrographic observations are to be considered essentially as a means of assisting our investigations, as we used these to obtain some notion of at what depths the pelagic fish eggs and young were to be found.

There has been no reason for the Biological Station to undertake extensive investigations into the conditions of temperature and salinity in Danish waters, as such investigations have been carried on for a number of years through the instrumentality of the Danish Meteorological Institute, in cooperation since 1902 with the *"Hydrografisk Laboratorium"*.*) These observations are taken daily, partly from places at the coast, partly from some of the *lightships* stationed in Danish waters. Determinations of temperature and salinity both on the surface and at different depths to the bottom are taken at the ligthships, and although these do not lie at the deepest spots, yet the results obtained give a good insight into the hydrographical conditions of the different regions. The direction and rate of the surface-current, the direction and force of the wind and other meteorological conditions are also noted at the lightships. All the observations mentioned are published by the Danish Meteorological Institute in the *"Nautisk-meteorologisk Aarbog"*. From the summary tables in that work the hydrographical conditions at the various places of observation can be followed from day to day throughout the year; the main features of the hydrographical conditions in Danish waters can therefore be ascertained from them.

A comparison of the observations from the lightships shows that the upper water-layers are everywhere of less salinity than the deeper. The salinity does not increase uniformly from the surface to the bottom, however, as a layer can always be detected at a greater or less distance from the surface, in which the

* Quarterly hydrographical observations are also conducted in Danish waters as part of the international investigations. As these give no information regarding the frequent hydrographic changes, I have paid no attention to them in this work, but have only used the daily returns from the lightships.

salinity suddenly increases. This layer thus forms a boundary between the salt bottom-water and the less salt surface-water.

The information the tables give concerning the direction and rate of flow of the surface-current shows that the main tendeney is from the true Baltic towards the North Sea. The movement of the deeper water-layers has not been investigated from the lightships, but it is obvious, that the salt water at the bottom must have its origin in the North Sea, and if not renewed fairly frequently, the boundary between the surface and bottom-water would quickly disappear; as a matter of fact the boundary usually remains very clear, as can be seen from the tables.

There is therefore no doubt concerning the truth of the following main rule, known for a long period, for the movement in Danish waters: *the water of low salinity from the true Baltic tends outwards to the North Sea along the surface, whilst a current of salt water is going in the opposite direction from the North Sea in towards the true Baltic along the bottom.*

The surface-water in the true Baltic usually has a salinity of less than 1 $^0/_0$, in the North Sea of 3 $^0/_0$ and more, and all transitional stages are found at intermediate places. This condition may be explained by *the surface-current as it passes towards the North Sea taking up water from the under-current.*

It will be readily understood, that the hydrographical conditions in Danish waters have a great influence on the distribution of pelagic organisms. I have only described the main features of these conditions however, preferring to show the deviations from the rule in their influence on the distribution and fate of the pelagic eggs and young of fishes.

Pelagic fish eggs.

The pelagic fish eggs are not evenly distributed in the Danish waters nor equally frequent at all times of the year. The Director of the Biological Station has often remarked on this in his papers, amongst which special mention may be made of "De danske Farvandes Plankton, I" (Tab. VI—XII and p. 246—255) and "Biol. Stat. Beretn. VII" (p. 15—18).

In "De danske Farvandes Plankton, I" the Director discusses the *plankton investigations* of 1898—1901. These investigations, as mentioned previously, were undertaken at several places in Danish waters, especially from lightships. Vertical hauls with the pelagic net were made twice monthly and this work was continued for two years (April 1899—April 1901). On Tables VI—XII of the work mentioned the Director gives the number and as far as possible the species of the eggs and young fishes taken in each single gathering.

A comparison of these Tables shows, that *very few pelagic fish eggs were taken in the Skager Rak and North Sea in January and February, that the numbers increased from January to June—July, a few were stilll found in August, but none at all in the following months until December* when a single egg was taken in the Skager Rak.

In the Kattegat pelagic eggs were taken in every month of the year. The numbers rose quickly in the first three months, much more quickly than in the North Sea and

Skager Rak; but from March to July they remained about the same level, in August they decreased and were quite inconsiderable in September to December.

The Great Belt resembled the Kattegat mostly in regard to the occurrence of the eggs, but the conditions were not so uniform.

In the Baltic only the surface layers were fished during the investigations 1898—1901 and eggs were found in but isolated cases.

Vertical hauls with the pelagic net from the bottom to the surface give good information concerning *the density of the eggs at the place investigated,* but show nothing as to *the depths at which the eggs are floating.* This problem must be solved in a different way. On pp. 250—254 of "De danske Farvandes Plankton, II" the Director has discussed the point in great detail.

In the "Biol. Stat. Beretn. XII" p. 15—18, the Director again refers to the question and remarks, that a boundary-line can be indicated at all times between the parts of the Danish waters where eggs are found on the surface and the parts where they first occur in deeper layers. This boundary was determined in March—April 1902 (l. c. p. 17—18) by a series of surface-hauls with the pelagic net, and at that time cut off the true Baltic, the eastern part of the Western Baltic as far as the south point of Langeland and also the Sound from the other Danish waters. East and south of this boundary no fish eggs were taken in the surface hauls with the pelagic net. The same line, which limited the occurrence of fish eggs in the surface-waters, also distinguished approximately the salinities on the surface of above and below 14 $^{0}/_{00}$.

The majority of the pelagic fish eggs float however in water-layers of somewhat greater salinity, as appears partly from our Table I (p. 72) partly from the summary of the occurrence of fish eggs at the surface and bottom of the Great Belt in 1899 in "De danske Farvandes Plankton I" p. 253.

The position of the eggs in the water-masses has great importance for their fate, since, as mentioned in the previous chapter, two opposing currents are usually passing through the Danish waters, an outgoing surface-current and an ingoing bottom-current. As soon as the surface-current on its way from the true Baltic to the North Sea attains a sufficient salinity to be able to support the pelagic eggs, these float upwards into it and are carried away in the direction of the North Sea; but until the surface-current is salt enough to be able to support the eggs, these remain in the bottom water and follow its movements. The conditions in the latter cases are more complicated and more difficult to observe than when the eggs are found in the surface-water. I shall therefore go a little more into detail on the occurrence of the pelagic eggs in those parts of the Danish waters where they are found in the bottom-water.

In consequence of Strodtman's remarks on "Der indigene Fischbestand der Ostsee" (Ehrenbaum und Strodtmann, l. c. p. 121—126), we paid special attention in 1904 to *the conditions in the Baltic* and took frequent observations there (see Tab. 7). The hydrographic conditions in the Baltic are somewhat different from those we find further north in Danish waters. Ehrenbaum and Strodtmann (l. c. p. 69) give a graphic representation of the conditions as to salinity in the Baltic in 1903. From this it appears that fairly salt water is found at the bottom both in the true Baltic and in the western part. In the true Baltic the salt water has

to be sought for at deeper layers than in the western part, but it holds good for both regions, that water of at least 15 $^0/_{00}$ salinity is found at the bottom at sufficiently deep places. As mentioned, some fish eggs at any rate can float at a salinity of 14 $^0/_{00}$; the conditions are present in both regions therefore for the occurrence of pelagic eggs. In the true Baltic we need only expect to find them near the bottom; in the Western Baltic, on the other hand, the surface-water is often of sufficient salinity to be able to float some of the pelagic eggs.

Our investigations in 1904 (see Tab. I) have also shown, that pelagic fish eggs can also be found at the surface in the true Baltic, but we have always found by far the greatest number in the deeper layers, as can be seen from Tab. I. Thus, whilst in the Great Belt, for example, we may distinguish between an occurrence in the surface-water and therewith a northgoing tendeney and an occurrence in the bottom-water and therewith a southgoing tendeney, in *the western Baltic* the condition is somewhat different.

The latter region can be divided according to depth into a western and an eastern part, separated by a line drawn from the south point of Langeland almost in a S.S.W. direction (see course of the 10 fathom line on the Chart (p. 24). *The eastern part of the western Baltic* forms the connection between the true Baltic and Great Belt, and both the outgoing surface-current and the ingoing bottom-current flow through it. *The western part of the western Baltic* lies outside of the main line of the current; the surface-water may perhaps be often renewed, but the deeper layers lie hidden at the bottom of a deep basin of 10—20 fathoms, which comes into communication with the other waters only by means of a narrow channel south from Langeland (see course of 10 fathom line on the Chart). This basin contains almost stagnant water. It has thus been proved, both by the German investigations (Ehrenbaum and Strodtmann, l. cit.) and our own (see Tab. I), that in the deep water between Als and Ærø great changes in the salinity occur but rarely, and the temperature here rises very slowly in the course of the summer, a sign that the water-masses at the bottom of the western part of the western Baltic are seldom renewed. As it is mainly in these water-masses that the pelagic fish eggs are found, *the eggs are therefore not carried away during development as in the Belts and Kattegat;* for this reason they are always taken in relatively large numbers in a vertical haul with the pelagic net at the deeper parts of the western portion of the western Baltic.

This region is not the only part of the Danish waters remarkable for retaining salt water-masses which are seldom removed. In "De danske Farvandes Plankton, I" p. 249 the Diretor points out, that places occur in the *Southern Kattegat*, where cold resting water-masses are found near the bottom, and he considers that these regions retain the pelagic eggs or at any rate retard their removal. Similar localities are found in *the north of the Little Belt* (between Funen and Endelave), in the Sound (the deep gut north of Hveen) and other places. These are always of importance in the Danish inner waters, not only for the occurrence of the eggs but also for the development of the eggs and young fish.

If we consider the conditions in *the true Baltic*, we find there only a further development of the conditions in the western part of the western Baltic. In the inner parts of the true Baltic *the upper water-layers cannot float the pelagic*

fish eggs, or if so only quite exceptionally. On the other hand *numerous pelagic fish eggs are found in the salt bottom-layers.* This can be seen from the "Tabelle der Fänge" (Ehrenbaum und Strodtmann l. cit.). In the shallower parts of the true Baltic Ehrenbaum and Strodtmann took no eggs in the vertical hauls. Nor in the deep gut N. E. of Bornholm, "Bornholmsdybet", 97 m. (ca. 50 fm.) did they take any eggs in the upper layers. It was only at depths of at least 50 m. (in May) — 60 m. (in August), in water of at least 11.24 ‰ salinity*, that they found the pelagic fish eggs, but as a sort of compensation in considerable numbers, both in May and August.

On the 9th of June 1904 (see Tab. I, true Baltic) we were to the east of Christiansø, almost at the same place as the Germans' "Bornholm Tiefe". We found there, as Ehrenbaum and Strodtmann had found in May and August 1903, a considerable number of pelagic fish eggs in the deeper salt layers of water. At a depth of 20 fathoms we repeatedly found single eggs of sprat, though we determined the salinity at this depth to be 6—9.9 ‰. At 20 fathoms depth however we were certainly very near the boundary of the surface-water; at 30 fathoms we found 12.5 ‰.

It is clear that the fish eggs found in the salt water in the gut N. E. of Bornholm are safe from being carried in a westerly direction by the surface-current. They may, however, if salt water pushes in from the west into the true Baltic, be carried further to the east. The renewal of the water in the bottom-layers N. E. of Bornholm must however be exceedingly slight**, as the temperature throughout the summer is very low. In "Bornholmsdybet" Ehrenbaum and Strodtmann in 1903 found a temperature of 3.16° C. at a depth of 90—95 m. (ca. 48—50 fm.) in May, and a temperature of 3.25—3.26° C. at 90—95 m. in August. On the 19th of June 1904 (see Tab. I) we ourselves found a temperature of 4.3° C. at a depth of 40—53 fathoms.***

Further to the east also, in the true Baltic, fairly salt water is frequently found at the bottom, but renewal takes place here and is of great importance, new salt water often forcing its way in from the Sound and from the western Baltic. *South of Møen there is a depression in the bottom of 10—12 fathoms,* which in its northern part is in connection with the greater depths to the east of Møen (see the Chart), but is elsewhere separated from these by a ridge which extends northwards from the German coast in the neighbourhood of Darsserort. This ridge is certainly raised but little above the level of the 10 fathoms, but in the true Baltic every such deepening of the bottom however small is of importance for the distribution of the pelagic organisms, as it retains some of the water which presses in from adjacent regions. In the XIIth Report of the Biological Station p. 16,

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* In the true Baltic we have often found pelagic fish eggs in water-layers with a salinity of ca. 11—12 ‰. In the cases where we have determined these eggs, they have always been those of the sprat.

** See also: *O. Pettersson:* "Redegörelse för de svenska Hydrografiska undersökningarna åran 1893—94". Bihang till K. Svensk Vet. Akad. Hand. Bd. 19 Afd. II. Stockholm 1893.

*** When we bring up the water-sampler from the depths of the true Baltic in the warm summer-months, it feels like ice to the fingers touching it, and a direct proof is thus obtained of the winter-cold which rules down in the deep layers.

the Director mentions that in February 1903 we found numerous pelagic eggs south of Møen but none in March 1903. Our investigations showed that the salinity at the bottom (12 fm.) in February was 17.4 ‰, in March 10.6 ‰. In March 1903 we also sought for pelagic eggs to the east of Møen, but did not find any until we were out in 22 fathoms depth and here only at less than a fathom's depth from the bottom. There can be no doubt that the pelagic eggs, found in February 1903 to the south of Møen, had now moved further to the east, if they had not succumbed. In April 1903, when we were again to the east of Møen, and in May 1903 when the German naturalists (Ehrenbaum and Strodtmann l. cit.) were making investigations there, the conditions were as in March; there were no pelagic fish eggs in less than 21 fathoms depth.

We may take it as certain, that *the fish eggs, which are spawned in the true Baltic, remain in that sea.* How far and to what extent *fish eggs are carried into the true Baltic from without*, is difficult to determine. In the western part of the Western Baltic we have often found the eggs confined to the bottom-water; for example:

D. 27—3—03. Staber Huk (Fehmarn) in S. W. to S.; 16 fm.
0 fm.—5.3 ° C. — 12.1 ‰ salinity
8 » —3.7 » — 18.7 » »
16 » —3.7 » — 21.6 » »
Pelagic net on the surface, 5 minutes: no eggs
» » at ca. 8 fm. » : » » .
» » on pole at bottom » : ca. 50 » .

The "Nautisk-meteorologisk Aarbog" also shows, that salt water often streams from the west part the lightship at Gedser Reef, that is, from the west into the true Baltic; the pelagic eggs must therefore accompany it.

Pelagic fish eggs must now and then be carried into the true Baltic through the Sound also, as very salt water, according to the "Nautisk-meteorologisk Aarbog", often passes down from the north past the light-ship at Drogden, which is anchored almost at the boundary between the waters mentioned.

From this it appears, that *pelagic fish eggs are frequent in all the Danish waters. In the North Sea, at least some of the eggs float in the upper layers, in the true Baltic they are only found near the bottom, and in the intermediate waters there are all transitional stages between these extremes. The eggs are carried from the Danish waters, according as they float in the surface or bottom-waters, sometimes in the direction of the North Sea, sometimes in the direction of the true Baltic. When the eggs are confined to the bottom-water, they are often retained where the bottom forms basins or depressions; especially is this the case in the western part of the western Baltic.*

The determination of the species of the pelagic fish eggs has not been made very completely during the investigations we have hitherto carried out. But few were made in 1903 and only when the Director was on board; nor in 1904 was much time used in the determination of the pelagic eggs. Nevertheless, in the latter year, the eggs of the rockling *(Onos sp.),* plaice *(Pleuronectes platessa),* flounder-dab *(Pleuronectes flesus-limanda),* sole *(Solea sp.)*, dragonet *(Callionymus sp.),* sprat *(Clupea sprattus)* have hardly ever escaped our attention, nor also those of the long-rough dab *(Drepanopsetta platessoides)*, except perhaps on the March cruise in

the western and true Baltic, when only a few determinations were made during the absence of the Director. Eggs of the cod *(Gadus callarias)* have always been determined, when they had the embryo in any way developed.

On account of the incompleteness with which the eggs were determined, I shall restrict myself to some few remarks on the composition of the stock of pelagic eggs in Danish waters and refer for the rest to Tab. 1 and the summary from this: Tab. 2.

During the first months of the year the eggs which occur are almost exclusively without oil-globules. In January 1904 we have only found eggs of *plaice*, in March also those of *cod, long-rough dab* and *flounder-dab*, all without oil-globules, and in addition single small eggs with one or several brownish oil-globules, which we have determined as those of the *rockling**. Long-rough dab eggs were only found in March, plaice and cod eggs right to April and May, rockling eggs still in June, and flounder-dab eggs in all months from March to August.

In the summer, from May and June on, most of the species of pelagic eggs have one or more oil-globules. We have only determined a few species with oil-globules, namely: *sole, dragonet* and in single cases *mackerel,* whilst with regard to the presence of the eggs of the *rhomboids, gurnards* and others we have been content with suppositions, but I have paid no attention to these in working out the tables. Of the eggs without oil-globules occurring in the summer months, in addition to the flounder-dab, we have only determined those of the *sprat.* These are however very common; in 1904 they were found in the months April—August.

Pelagic young from species with pelagic eggs.

The young fish which are hatched from pelagic eggs are not restricted in the same degree as the eggs to water-layers of a certain salinity; yet, during the first period of development especially, they will remain in the water-layers where they are hatched. The influence of currents on the pelagic eggs is thus continued on the pelagic young; and these are carried from the intermediate regions either outwards towards the North Sea or inwards towards the true Baltic. It is only where the salt water on account of the configuration of the bottom is somewhat stationary, that the pelagic young like the pelagic eggs are saved from being carried away. In the intermediate parts of the Danish waters therefore, we find but few places, chiefly in the western part of the wester Baltic, where a large number of the pelagic young of species with pelagic eggs are to be met with. In searching for the great mass of these young we must follow the currents which carry away the eggs, thus, both the surface-current out towards the North Sea and the bottom-current in towards the true Baltic. We have for example actually found these young in the Skager Rak in great numbers (see Tab. 1), but neither in 1904 nor in earlier years have we found the pelagic young of pelagic eggs in the true

* Some of the eggs we have determined as rockling belong perhaps in reality to the *forkbeard (Raniceps raninus),* the adult of which is occasionally taken in Danish waters, e. g. in the Little Belt.

Baltic, except for quite isolated, single specimens*. We have however only investigated the conditions at and in the neigbourhood of Bornholm.

If we compare the numbers taken each month *of the young from pelagic and those from demersal eggs,* as shown by the summaries (Tab. 3), we see that in spring it is almost exclusively the young from demersal eggs which are found; for example, in 1904 apart from *Clupea*-young, over 1500 young from demersal eggs were taken in February and March, but only 10 young from pelagic eggs. These latter belonged to the *cod (Gadus callarias), rockling (Onos sp)* and *plaice (Pleuronectes platessa).*

In April, May and June there was a considerable number of pelagic young from species with pelagic eggs. The Skager Rak and the Western Baltic especially show large numbers (see Tab. 3 B). In April and May they belonged to the species: cod, rockling, *long-rough dab (Drepanopsetta platessoides),* plaice, *flounder (Pleuronectes flesus)* and *dab (Pleuronectes limanda)*; in the Skager Rak also, the *haddock (Gadus aeglefinus), whiting (Gadus merlangus)* and *Norway pout (Gadus esmarkii).* In June the young found were almost the same as in April and May; but pelagic young of whiting were also taken in the Kattegat and Great Belt and pelagic young of the Norway pout in the Kattegat. The rhomboids: *turbot (Bothus maximus), brill (Bothus rhombus)* began to appear but only in single specimens. Cod, long-rough dab, plaice and flounder end their pelagic life in June, whilst the pelagic young of the dab are more common then than those of any other species.

In July we found a larger number of species of pelagic young of pelagic eggs species than in any other month. The new-comers were the *scaldfish (Arnoglossus laterna), Norway topknot* and *Müller's topknot (Zeugopterus norvegicus* and *punctatus), sole (Solea sp.), mackerel (Scomber scomber), wrasses (Labrus sp.)* and *dragonet (Callionymus sp.).* The young were found almost exclusively in the southern Kattegat (see Tab. 1, Kattegat).

In the following two months, August and September, there are extremely few pelagic young of species having pelagic eggs. These belong almost exclusively to the rockling and dab in the waters within the Skaw. In the North Sea A. C. Johansen found isolated specimens of the pelagic young of *gurnards (Trigla sp.)* and *weever (Trachinus draco)* as well as some pelagic young of the rockling and scaldfish in September.

In October 1904 A. C. Johansen found 4 pelagic young of the *Great Silver Smelt (Argentina silus)* in the Skager Rak and 1 pelagic young of the gurnard. These 5 specimens were the only young from pelagic eggs taken in October, though a great deal of fishing was carried on with the young-fish trawl in this month, especially in the Skager Rak and Kattegat. In October therefore almost all the young from pelagic eggs have given up the pelagic habit.

The young of the *sprat (Clupea sprattus)* has not been separated from those of the *herring (Clupea harengus).*

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* In the deeper parts of the true Baltic numerous eggs of cod and plaice have often been found. We have not up to the present found pelagic cod young in the true Baltic, and the pelagic young of the plaice occur only exceptionally there and only in the western part near Møen. Cod and plaice thus do not develop in the true Baltic, which is probably connected with the extremely low temperature ruling in the deeper, egg-carrying water-layers.

The occurrence of the pelagic young of various species having pelagic eggs will be described in more detail in the special part, but only for those species, whose development and distribution in the various stages we have learnt to know best during our investigations, namely: cod, whiting, plaice, flounder, dab aud long-rough dab, as also the two gadoids: haddock and Norway pout, the distribution of which in the pelagic stages is specially interesting,

Pelagic young from species with demersal eggs.

The fish young hitherto mentioned are all hatched from pelagic eggs; but a large number of young occur in Danish waters, which come from species with eggs fixed to the bottom or to its plant-vegetation (the eggs are therefore called demersal).

The conditions of distribution for these young are much less complicated than for those which come from pelagic eggs, because the fixed eggs do not come under the influence of currents; and it is only when the young are hatched that they go with the stream. The young of fish with demersal eggs are therefore most frequent in the neighbourhood of the coast, and appear in much greater numbers in the smaller waters than in the Skager Rak and North Sea. This is seen in our catches for 1904 for example. The summary of these (Tab. 3 B) shows, in the column for the young of species with demersal eggs, that the greatest numbers are always found in the inner waters, including the Kattegat, whilst the North Sea and Skager Rak are represented by small catches.

Amongst the young of fishes with demersal eggs are some species, which appear pelagically in winter and spring, whilst other species pass though their pelagic stages in the warm period of the year. The great majority of the species belong to the latter class, but richness in numbers is not in proportion to the numbers of species, as many of the young hatched from demersal eggs in the course of the summer pass the whole of their early life near the bottom amongst the plant-vegetation, often in shallow-water. It is only exceptionally that they are met with free in the water and are taken in the hauls in intermediate layers, and it is only such cases that are brought into the lists amongst the pelagic young.

The earliest pelagic young of fishes with demersal eggs may be divided into two main groups: the cottoids and the "elongated larvæ". The cottoids are represented by the *common sea-scorpion (Cottus scorpius)* and the *pogge (Agonus cataphractus)*. Both these species are very common in the first months of the year; they will be mentioned more particularly in the description of the species. Amongst the "elongated larvæ", the *herring* and *sprat (Clupea sp.), Lumpenus (Lumpenus lampetriformis), gunnel (Centronotus gunellus)* and *sand-eels (Ammodytes sp.)* are the most frequent. A key to the determination of these is given by the Director in "De danske Farvandes Plankton" I, p. 246—247. Amongst the elongated larvæ must also be reckoned the pelagic young of the crested blenny *(Carelophus ascanii)* and *cat-fish (Anarrhichas lupus),* which belong to the rarer visitors in Danish waters. Like the cottoids the "elongated larvæ" are most abundant in the first months of the year. They decrease in number in April—May and quite

disappear in June. This rule does not hold however for the clupeoid young nor altogether for the sand-eels. Pelagic young of *Clupea* appear both in spring and in autumn with a break in the summer months. The larvæ of the two last-named, *Clupea* and *Ammodytes*, have not been determined as to the species in our collections. Under *Clupea sp.* are included the young of *Clupea harengus* (herring) and *Clupea sprattus* (sprat); and *Ammodytes sp.* includes at least two species, *Ammodytes lanceolatus* and *Ammodytes lancea*. On account of this, I shall not go very deeply into a description of the occurrence of the *Clupea* and *Ammodytes* young, but postpone this until determinations of the species are to hand. The other "elongated larvæ" however will be mentioned more particularly in the description of the species.

The *long-spined sea-scorpion (Cottus bubalis), liparids (Liparis sp.)* and *lumpsucker (Cyclopterus lumpus)* appear somewhat later than the above-mentioned. Of these the young of *Cottus bubalis* will be described later with those of *Cottus scorpius*. The young of *Liparis* are undetermined. They are found in the months of February—July and in all the Danish waters. The material certainly contains several species, at all events *Liparis liparis* and *Liparis montagui*. I shall therefore postpone the description of our catches of the Liparis young, until these have been determined.*

The young of the lumpsucker are only exceptionally met with pelagically, as the early stages are usually passed amongst the plant-vegetation in shallow water. Even when we have taken the young of the lumpsucker in intermediate hauls, we have often been in doubt as to how far they really were pelagic or were fixed by their suckers to the floating pieces of weed or other objects, along with which they were as a rule taken. This has sometimes been actually observed but as we have in other cases taken the young lumpsuckers in intermediate hauls without the net containing anything to which the young could hold, they must be able to live the pelagically.** In the case of the lumpsucker therefore there is

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* After this Report had been completed, I have succeeded in separating our material of Liparis young into two forms, one of which can certainly be referred to *Liparis montagui*, whilst the other probably belongs to *Liparis liparis*, though *Liparis barbatus* is not excluded.

I have drawn together the results of my determinations into the following little table:

+ = *Liparis liparis(?)*, O = *Liparis montagui.*	Skager Rak	Kattegat	Sound	Great Belt	Little Belt	Western Baltic	True Baltic
March	—	—	—	—	—	+	+
April	—	+	—	—	—	—	—
May	—	+ O	—	+	+	+	—
June	+	+ O	+ O	O	O	—	+
July	—	O	—	—	—	—	—

It will be seen that the young of *Liparis liparis(?)* appear earlier than those of *Liparis montagui*, as we have taken the young of *Liparis liparis(?)* in the months March—June, of *Liparis montagui* in May—July. We have not taken the young of *Liparis montagui* in the western or true Baltic.

** Not only the young but also older specimens of the lumpsucker can live pelagically. We have sometimes taken these in intermediate hauls with the young-fish trawl, and one time, 10—8—04, in an experimental haul with a herring trawl in the Great Belt we took a lumpsucker of ca. 20 ctm.; the herring trawl was fishing in intermediate depths.

no distinction between a pelagic and a bottom-stage, and to follow the occurrence of the young in the various stages of development we must combine pelagic investigations with investigations of the young amongst the plant-vegetation on the coasts. We have often undertaken the latter kind of investigation, but it is only when they contributed to solve the question of the distribution of the cod in the bottom-stages that they are mentioned in this Report. For this reason I must postpone further description of the young of the lumpsucker.

The greater number of specimens of the young from demersal eggs which appear in the summer time consists of *gobies* (Family: *Gobiidæ*). We have not usually distinguished between the young of the various species of *Gobius* in our collections, nor have we always separated the young of *Aphya pellucida* and *Crystallogobius nilssonii* from the young of *Gobius*. Consequently the material shows but little regarding the occurrence of these young. Further, the young of the gobies like those of the lumpsucker often pass the whole of their development near the bottom amongst the plant-vegetation. I have not wished therefore to use our catches of the young of *Gobius* for any description of the early life of these species. For a similar reason I have refrained from mentioning the other young forms from demersal eggs occurring in summer, namely: of the sticklebacks *(Gasterosteus aculeatus* and *pungitius),* fifteenspined stickleback *(Spinachia vulgaris),* garfish *(Belone acus),* and pipe-fish *(Syngnathus sp.* and *Nerophis sp.).* They are not dealt with in the descriptions of the species, as they often pass the whole of their early life amongst the plant-vegetation.

The bottom-stages of young fishes.

During the development of the young fish great changes take place in their anatomical structure and pigmentation. It is thus said that the larvæ *undergo metamorphosis*, and by *completely metamorphosed** young fish is meant the young which resemble the adult fish in regard to body-form, development and number of rays in fins, etc. The metamorphosis begins in the pelagic stage, but is usually continued after the close of this period. In the present Report, in which I deal specially with the conditions of distribution of the young, I have not paid so much attention to the degree of metamorphosis as to the mode of life of the young, whether in intermediate layers of water or at the bottom.

The majority of young fish after a longer or shorter pelagic existence approach the bottom, on which or near to which they pass the rest of their life, but in the transition to the bottom-stage a separation occurs between the young of the different species which have hitherto lived together in intermediate water-layers under essentially the same outer conditions. Some species seek the bottom in shallow water, others in deep, some prefer ground covered with vegetation others the uncovered ground.

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* In talking of metamorphosed young of flat-fish in the special part, I mean the stages of these fish with the transformation of the eye so far advanced that both eyes are on the same side of the head. The term "transition stages" I use for the stages of development which intervene between the symmetrical and the metamorphosed stages.

The search for the bottom-stages has been carried out partly from the »Sallingsund«, partly from a small boat, and partly by wading. From the »Sallingsund« we have used the young-fish trawl on the bottom, sometimes on blocks, especially on the plant-vegetation. We have investigated sometimes the deepest places in each of the various regions sometimes the shallower waters right in to ca. $1^1/_2$ fathoms.

I shall here restrict myself to our investigations, as A. C. Johansen will discuss his own catches of the bottom-stages taken during the cruises with the »Thor«.

Bottom-stages of species with pelagic eggs.

In deep water we have taken the bottom-stages of the *cod, whiting, dab* and *long-rough-dab*. The bottom-stages of the cod and whiting have usually however been taken in shallower water amongst the plant-vegetation.*

The bottom-stages of the *plaice* and *flounder* have only been taken during our use of the young-fish trawl from the »Sallingsund«, when we fished on clean sandy bottom near the coast (see however p. 42). Usually however the clean, sandy flats in the waters within the Skaw do not extend out into depths, where the »Sallingsund« can come; and we have therefore been obliged to investigate the sand at the coasts from a small boat or by wading. These, the socalled coast-investigations were carried out by means of shove-nets of various fineness as well as small-meshed seines. In addition to plaice and flounder we also caught there the bottom-stages of the *sole, turbot* and *brill*.

When I mention further that we sometimes found the bottom-stages of labroids *(Labrus sp.)* on algæ-covered ground, the list of the species with pelagic eggs whose young in the bottom-stages were found in Danish waters within the Skaw is ended. Even the species named are usually found in greater number in the bottom-stage in the waters beyond the Skaw than inside this. The reason for this, as already mentioned, is that the currents affect the pelagic eggs and young and carry away the majority from the waters within the Skaw before the bottom-stage is reached.

Bottom-stages of species with demersal eggs.

Like the young of species with pelagic eggs, the young of species with demersal eggs seek different kinds of localities in the transition to the bottom-stage. The greatest number of species are found amongst the plant-vegetation at the coasts. We have found there the young of the *three- and nine-spined stickleback (Gasterosteus aculeatus* and *pungitius), fifteenspined stickleback (Spinachia vulgaris), viviparous blenny (Zoarces viviparus)*, some species of *gobies (Gobius sp.), lumpsucker (Cyclopterus lumpus), garfish (Belone acus)*, as also of species of pipe-fish *(Syngnathus sp.* and *Nerophis sp.)*. The species of young mentioned have however no well-marked pelagic stage, but are in more or less degree bound to the plant-vegetation

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* On such a locality we once took a *pollack (Gadus pollachius)*, which perhaps belonged to the 0-group.

D. 2—11—03. Off Staureshoved (Great Belt), ca. 4 fm. *Zostera,* stones. Dan. trawl: 1 *Gadus pollachius*, 14 Ctm.

during the whole of their early development (see section on "Pelagic young of species with demersal eggs"). They are therefore but little exposed to the danger of being carried away by currents and are extremely common everywhere in Danish waters wherever the conditions are favourable to their occurrence.

The case is quite different for the young of those species with demersal eggs which have a true pelagic stage. In this stage they come under the influence of the currents, and the result is that their bottom-stages are seldom found in the waters within the Skaw. We have thus only occasionally found the bottom-stages of the *common* and *long-spined sea-scorpions (Cottus scorpius* and *bubalis), pogge (Agonus cataphractus), gunnel (Centronotus gunellus), liparids (Liparis sp.)* and *sand-eels (Ammodytes sp.),* the last on sandy and shallow water, the others on algæ-covered, often stony bottom near the coasts.

The metamorphosed young of *Clupea* are often met with in extremely great numbers on the North Sea coasts of Jutland, in the northern Kattegat and in the Lim Fjord. In our inner waters they are but few in numbers.

The bottom-stages of *Lumpenus (Lumpenus lampetriformis)* keep to soft bottom in deep water (ca. 20 fathoms or more). We have found them in very great numbers in the western part of the Western Baltic, from which the currents do not carry away the pelagic young (see p. 63), and where the bottom-stages have specially good conditions for their occurrence. Elsewhere we have taken the bottom-stages of Lumpenus in numbers in the true Baltic and in single specimens at deeper places in the Kattegat.

With regard to the young of the gobies I can give but little information owing to the defective determination of the species. It appears as if the young and adults of *Aphya pellucida* and *Crystallogobius nilssonii* can live pelagically, as we obtain both in intermediate hauls.

It way be given as a rule, that *the bottom-stages are few in numbers in Danish waters within the Skaw.* (This will be shown in more detail in the special part.) If we have therefore a relatively rich stock of fish in our inner waters, even of the species the bottom-stages of which are wanting or occur there seldom, this is due to the fact that these, as soon as the bottom-stage is reached, begin to wander into the waters from which the currents have carried them during development.

Concluding Remarks.

The features of the distribution of the pelagic eggs and young fishes in Danish waters will be most easily understood if we compare them with the distribution in more open waters, where the hydrographical conditions are not so complicated. Before describing the occurrence of the eggs and larvæ of the separate species, I shall therefore refer to the extremely clear picture which Johs. Schmidt has given of the distribution of the pelagic eggs and young of fishes on the coasts of Iceland; see "Fiskeriundersøgelser ved Island og Færøerne i Sommeren 1903". (Skrifter udg. af Komm. for Havunders. Nr. 1, 1904.)

On p. 42 Johs. Schmidt states: "the line from Ingolfshöfði, which gives a good picture of the momentary condition in the ocean south of Iceland, shows that on open oceanic coasts such as that at South Iceland belts or zones out from the land can be distinguished, which differ as to their contents of floating eggs and young fish. These belts are there as follows:

I. Nearest to land (in the surface of the shallow water) appear quantities of *pelagic eggs and the tiny young of species which have demersal eggs* (herring, *Mallotus,* sand-eels etc.).

II. Further from the land (over somewhat greater depths) are found no pelagic eggs, but the *tiny young of species* which have *pelagic eggs* (gadoids and flat-fishes) as well as the *larger young from demersal eggs*; these last disappear gradually as we go further out giving place to the *older young from pelagic eggs.*

III. Furthest from land, even out over the greatest depths, are found the young of the Norway haddock *(Sebastes)* . . ."

I shall endeavour to use this belt-grouping of Johs. Schmidt for our home-waters. The belt last mentioned I leave out of regard, as it falls outside the area in which we have the opportunity to make investigations. Belts I and II remain. At Iceland these belts are caused by the coastal water tending offshore and carrying with it the pelagic eggs and young, which are thus during development removed further and further from the coast. The conditions are more complicated in the Danish waters. As the water-layers bearing the eggs and young fish approach the bottom in the direction from the North Sea in towards the true Baltic, the distribution of the pelagic eggs and young is effected not only by the outgoing surface-current but also by the bottom-current moving in the opposite direction. In the intermediate parts of the Danish waters we thus have a region from which the pelagic eggs and young are carried either in the one or the other direction. This region, which embraces the Great Belt and the Sound with their extensions towards the north and south, corresponds approximately to Belt I; it contains numerous pelagic fish eggs and the pelagic young from demersal eggs, but only a few of the tiny young from the pelagic eggs.

If we follow the surface-current out through the Kattegat, we find conditions in the Skager Rak which approximate nearest to those of Schmidt's Belt II. There are pelagic eggs in the Skager Rak certainly; but they are not, especially in the first months of the year, so numerous there as in the Kattegat and Great Belt (see p. 10) and the stock of pelagic young in the Skager Rak is composed essentially of the young from pelagic eggs.

If we now turn to the under-current, we see that it must sooner or later, in its deep course through Danish waters, come to include the water-layers bearing the eggs and young. We must therefore expect, that by following the under-current we shall come to regions which belong to Schmidt's Belt II. We meet such regions in fact at places, where the current ceases to flow on account of unevenness in the bottom, as in the western part of the western Baltic. Here however we have not only Belt II represented but also Belt I, as we find pelagic eggs in quantities and also numerous pelagic young from both demersal and pelagic eggs.

If we follow the under-current into the true Baltic and seek there for a

region, which might be referred to Belt II, we are disappointed. Pelagic eggs are found in quantities in the deeper parts of the true Baltic but the corresponding pelagic young are absent.

*The Danish waters within the Skaw are therefore most like Belt I, outside the Skaw most like Belt II.**

My endeavour to use Schmidt's system of belts for Danish waters has clearly shown, that the pelagic conditions here are very complicated. And yet I have restricted myself to the main outlines without regard for the many variations, which are chiefly caused by the periodic and occasional changes in the hydrographic conditions. I shall mention and show evidence of the existence of these variations in the special part of this Report.

Special Part.

1. Species with pelagic eggs.

Cod, *Gadus callarias.*

Investigations in 1904.

Table A gives a summary of our catches of cod eggs and young in 1904. The table is in three parts: the first contains the eggs, the second the pelagic young and the third the bottom-stages. The catches in each region are given for each month, but only the months in which either eggs or young were taken are noted. As regards the eggs, it is only noted if they were found (+) or sought for but not found (÷), also for the young what number was taken and how many minutes the hauls lasted. For the capture of the pelagic young the young-fish trawl was used in intermediate waters, for the bottom-stages the same apparatus on the bottom. The first and second parts of the Table are direct copies of Tab. 2 and Tab. 3 B (see p. 83, 84). In the third part the number of young captured and the time the young-fish trawl was at the bottom during the investigations are taken from an unprinted table (bottom-stages in the Danish waters in 1904).

As can be seen from Tab. A we have in 1904 found the *cod eggs* in March, April and May; in March however only in the northern waters. It is not excluded however that there may have been cod eggs also in the southern waters in March, as but few determinations of eggs were made during our cruise in the western and true Baltic in March.

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* With regard also to the distribution of the bottom-stages we can distinguish between the waters within the Skaw, where such young are scarce, and the waters outside the Skaw, where they are common. I shall not dwell upon this matter here, however, as the catches of the bottom-stages by the »Thor« are to be described elsewhere.

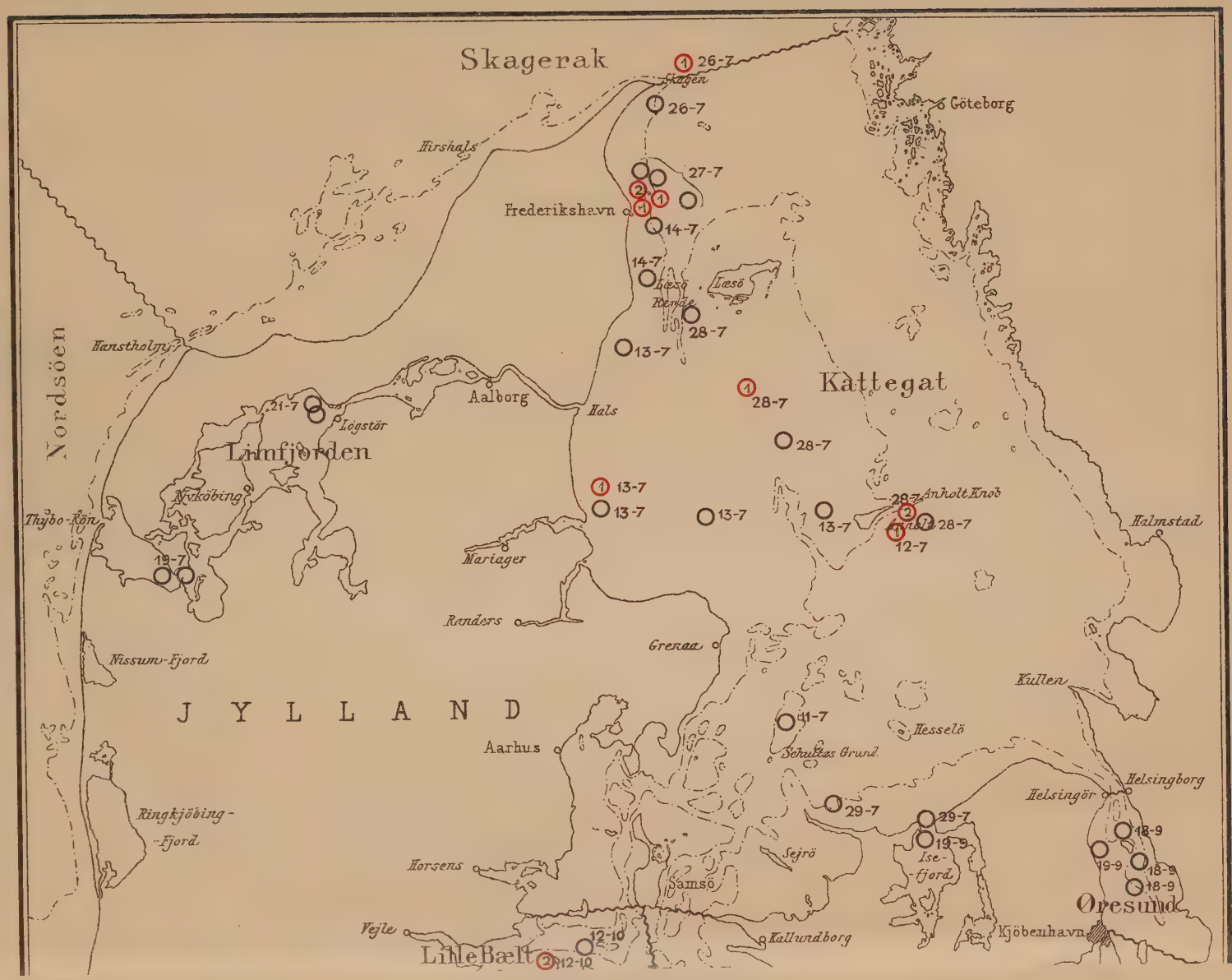
Tab. A. Eggs and young of cod, 1904.

		North Sea	Skager Rak	Kattegat	Lim fjord	The Sound	Great Belt	Little Belt	West Baltic	True Baltic
1. Cod eggs. Pelagic net (+ = eggs found, ÷ = sought for but not found).										
March		—	+	+	—	—	+	—	÷	÷
April		—	+	+	+	—	+	—	—	—
May		—	—	+	—	—	+	÷	+	—
2. Pelagic young of cod. Youngfish trawl in intermediate waters.										
February	Number of minutes ..	55	110	60	—	—	—	—	—	—
	» young	**1**	**2**	**0**	—	—	—	—	—	—
March	Number of minutes ..	—	270	715	—	—	42	—	90	85
	» young	—	**0**	**1**	—	—	**1**	—	**1**	**0**
April	Number of minutes ..	—	35	190	70	—	50	—	—	—
	» young	—	**127**	**32**	**7**	—	**2**	—	—	—
May	Number of minutes ..	—	—	170	—	—	275	20	170	—
	» young	—	—	**6**	—	—	**60**	**12**	**131**	—
June	Number of minutes ..	—	60	245	—	30	115	160	130	120
	» young	—	**25**	**29**	—	**1**	**0**	**17**	**45**	**0**
3. Bottom-stages of cod. Young-fish trawl on the bottom..										
June	Number of minutes ..	—	15	40	—	—	40	30	85	35
	» young	—	**0**	**0**	—	—	**0**	**20**	**2**	**3**
July	Number of minutes ..	—	—	280	70	—	45	—	—	—
	» young	—	—	**8**	**0**	—	**0**	—	—	—
August	Number of minutes ..	—	—	—	—	—	20	15	76	—
	» young	—	—	—	—	—	**0**	**22**	**53**	—
Septbr.	Number of minutes ..	—	—	—	—	15	59	—	20	60
	» young	—	—	—	—	**0**	**0**	—	**2**	**1**
Octbr.	Number of minutes ..	—	—	—	—	—	10	115	—	—
	» young	—	—	—	—	—	**0**	**52**	—	—

Pelagic young of cod were taken in 1904 as early as *February*. On the »Thor's« spring cruise in 1904 A. C. Johansen took two tiny young in the Skager Rak on the 17th of February and one in the North Sea on the 26th of February (see Tab. 1). Apart from these we have not taken the pelagic young of cod in February 1904. Even in *March* the pelagic cod young are few and small. In 1904 extensive investigations were made during March in all the Danish waters from the Skager Rak to the true Baltic, 44 hauls altogether of a total duration of ca. 20 hours being made in the intermediate waters with the young-fish trawl; a very large number of the young from demersal eggs was taken (see Tab. 3 B), but only three, all small, young of the cod, one in the Kattegat, one in the Great Belt and one in the true Baltic.

Up to April, therefore, we have nowhere taken the cod young in quantities, but we have found them singly in most of the Danish waters from the North Sea to the true Baltic.

In *April* and *May* 1904 we have found the pelagic cod young in all waters, where we sought for them, but not evenly distributed everywhere. Of the 377 pelagic cod young taken in the months mentioned, 127 come from the Skager Rak and 131 from the true Baltic, yet no great time was spent on the investigations


Skagerak
Nordsöen
Limfjorden
Kattegat
JYLLAND
Skagen
Hirshals
Hanstholm
Thybo-Kön
Nykøbing
Løgstör
Aalborg
Hals
Frederikshavn
Læsø
Anholt Knob
Mariager
Randers
Grenaa
Nissum-Fjord
Ringkjöbing-Fjord
Aarhus
Horsens
Vejle
Lille Bælt
Samsö
Sejrö
Kallundborg
Schultzes Grund
Hesselö
Kullen
Helsingör
Helsingborg
Ise-fjord
Öresund
Kjöbenhavn
Halmstad
Göteborg
26-7
27-7
14-7
28-7
13-7
21-7
19-7
12-7
29-7
19-9
18-9
12-10

AXEL E AAMODTS LITH. ETABL. KBHVN

in these regions. In the Skager Rak indeed the 127 cod young were taken in two hauls of altogether 25 minutes with the young-fish trawl:

D. 28—4—04. Skaw lightship in the south, $1^1/_2$ miles, 40 fm., young-fish trawl — 12 fm., 2 hauls of altogether 25 minutes: 127 *cod young*, 65 haddock young, 6 whiting young, 3 young of *Gadus esmarkii* as also many other fish young.

In April (16th—22nd, see Tab. 1) great quantities of cod eggs, which hatched out on standing a short time, were taken in the Lim Fjord. The young themselves however were very scarce and small.

In the Kattegat, investigations were made both in April and May; pelagic cod young were taken in both months, yet most in April.

In the Great Belt we also found the pelagic young cod in April and May; but if we consider that over 5 hours were occupied in fishing, the numbers taken, 62, are not considerable. In the Little Belt (see Tab. 18—5, Baaring Vig) we took 12 pelagic cod young in two hauls with the young-fish trawl, each of 10 minutes.

The condition in April and May was thus, that the pelagic cod young were most abundant in the Skager Rak and the western Baltic with the Little Belt, less numerous in the Kattegat and Great Belt.

In *June* we have likerwise taken relatively by far the greatest number of pelagic cod young in the Skager Rak and western Baltic, few in the Kattegat, a single small specimen in the Sound, none in the Great Belt. In the true Baltic there seem to have been no pelagic cod young in June.

In *June* the pelagic cod young were being displaced in our catches by the **bottom-stages.** The young-fish trawl was used on the bottom, sometimes on grounds near the coast covered by *Zostera* or algæ, sometimes on the clear, usually soft bottom in deeper water. Bottom-hauls with this apparatus were also made before June, but without taking any bottom-stages of the cod, just as, on the other hand, the use of the trawl in intermediate water-layers during July and following months gave no pelagic young of this species.

The differences in the distribution of the cod young, which we have already been able to show for the pelagic stages, are even more conspicuous when the young pass over to the bottom-stage.

The accompanying chart shows the catches of the bottom-stages of the cod in 1904. The stations where these young were taken with the young-fish trawl on the bottom are marked by red crosses, the numbers calculated for hauls of 10 minutes are denoted by a number inside the cross, and the date is added. The places where bottom hauls with the young-fish trawl were made after the 1st of July, without cod young being taken, are marked by a black cross, also with the date added.

As will be seen from the chart, we have in 1904 taken no bottom-stages of the cod at all from Anholt to the east of Zealand as far as Møen, and to the west of Zealand as far as Gjedser. Nor have we found them in the Lim Fjord in 1904. In the northern Kattegat and in the true Baltic, south and east of Møen, we took single specimens but seldom more than one in a haul. The result was quite different in the Little Belt and western part of the western Baltic. At these places the chart has scarcely room for the red crosses, and the numbers in these often run to two figures.

The obvious difference which the three ways of communication between the Baltic and the Kattegat show with regard to the young of the cod, both for the pelagic and especially the bottom-stages, is caused by the hydrographic conditions.

It has been shown p. 14 how these cause the pelagic fish eggs and young to be carried from the intermediate parts of the Danish waters, partly out towards the North Sea, partly in towards the true Baltic. This must be the reason, why the Great Belt was quite empty of cod young in July, though in May the pelagic stages were not so few in numbers, also why the bottom-stages were absent from the southern Kattegat, Great Belt and the eastern part of the western Baltic, but were present in the northern Kattegat and true Baltic.

The abundance of the bottom-stages in the western part of the western Baltic is also explicable in the same way. In the deep region west and south of Ærø the cod eggs float in the salt, resting water-layers at the bottom (see p. 12). The eggs hatch out there and the young develop without being carried away. Only the young which rise to the surface during development are caught and carried off by the surface-current.

In order to follow the **growth** of the cod young, we have measured all we took in 1904. The measurements are given in Tab. D (p. 30) in somewhat summarised form, all those taken in the course of one month in each region being brought together. All cod up to 20 cm. are included in the lists, in which the limit between the 0 and I groups stands out clearly the whole year through.

The first cod young taken in 1904 were caught in February; but most of them were under 1 cm. even in May. In June, at the period when they were going over to the bottom-stage, the cod young began to grow quickly. The growth is somewhat dependent on the regional conditions, as appears clearly from Tab. D when we compare the Little Belt with the western Baltic. In June the pelagic young and the bottom-stages were taken in both regions; but both classes of young were largest in the Little Belt, where at an earlier date there were relatively fewer of the bottom-stages than in the western Baltic. The investigations were carried out almost at the same time, viz. 13th and 14th of June. The difference is even more marked in August. In that month we took cod young of the 0-group of 8—12 cm., most at 9 cm., in the Little Belt amongst the plant-vegetation in shallow water; in the western Baltic, on similar ground, we found the cod young to be from 5—9 cm., most at 6 cm. There is thus a great difference in the size of the cod young in August even in waters situated so near to one another as the Little Belt and the western Baltic. The difference holds good, however, not only for the young from different waters but also for those from different localities of the same region. It is always found that the young taken in shallow water on algal covered ground are larger than those taken at the same time on clear ground in deep water. I have made this difference conspicuous in Tab. D by placing the August hauls in the western Baltic in two lists, one for the algal covered ground and one for the clear ground. The young taken on clear ground of 18—20 fm. are 4—7 cm. in length, the majority 5 cm., whilst those from the algal ground, as already mentioned, are 5—9 cm., the majority 6 cm. *The cod*

young therefore do not grow at an equal rate, not only in different waters but also on different grounds and depths within the same region.

Investigations in earlier years.

The conclusions I have drawn from our investigations of the cod eggs and young in 1904 are fully confirmed by the results of earlier investigations. These certainly differ in details from the results in 1904 but in the main there is no difference.

When the Biological Station was in Fænø Sound in **1891—92**, the Director took the cod eggs from January to May and the pelagic young in April—June (see "Biol. Stat. Beretn. III").

In the collections taken in the years **1899—1901** at various places in Danish waters (see "De danske Farvandes Plankton I"), cod eggs were found in March—May, the pelagic young in April and May. The January and February collections contained no cod eggs, at least none could be determined with certainly as cod eggs. There are indeed but few pelagic eggs in Jannuary and February, as mentioned on p. 10, and the observation of the Director in Beretning III from the Biological Station ("Det pelagiske Liv i Fænø Sound 1901—02"), that the cod eggs were frequent in the Fænø Sound, is perhaps due to the intensive fishing with the pelagic net which hung out in the current for hours.

In **1902** investigations on the cod eggs and pelagic young were carried on in the Little Belt in March, April and May. The eggs were found in all three months, the pelagic young only in April and May, in greatest numbers io May. The pelagic young were also found in other waters in 1902, and it may be specially remarked (see Tab. B, p. 28), that 6 pelagic young of $^1/_4$—$^3/_4$ inches (ca. 1—2 cm.) were taken in the Great Belt in June, whilst in 1904 no cod young at all were taken there in that month. In relation to this is the fact that not a few bottom-stages of the cod were taken in the Great Belt in 1902.

Nevertheless the same characteristic distribution of the bottom-stages is shown in 1902 as in 1904. Many bottom-hauls were made with the young-fish trawl in the Sound during July and September but without result; similarly in the waters of Smaaland and on the west coast of Zealand in July. On the other hand numerous cod young were taken on the coasts of Funen, not only on the coasts towards the Little Belt and western Baltic but also towards the Great Belt, as will be seen from the following Journal extracts:

D. 25—6—02. Off Staureshoved (Great Belt, east coast of Funen), 3—4 fm., *Zostera* and algæ. Young.fish trawl on the bottom, 8 minutes: 8 cod (0 gr.), 8 larger cod as also other fish.

D. 25—6—02. South from Staureshoved, 6 fm. Young-fish trawl on the bottom, 7 minutes: 9 cod (0 gr.), 26 larger cod as also other fish.

D. 25—6—02. Kerteminde Bay (east coast of Funen), 6—5 fm. Young-fish trawl on bottom, 10 minutes: 17 cod (0 gr.), 12 larger cod as also other fish.

Cod (0-group) were also taken in August 1902 in the Great Belt:

D. 28—8—02. Kerteminde Bay, 8 fm., small English trawl, 10 minutes: 4 cod (0 gr.), 2 larger cod as also other fish.

In the Little Belt and the western Baltic even more of the bottom-stages were taken:

D. 25—6—02. N. N. W. from Fogsand (Little Belt), 6 fm, *Zostera* and algæ. Young-fish trawl on bottom, 6 minutes: 25 cod (0 gr.) and some other fish.

D. 25—6—02. W. S. W. from Æbelö lightship (Little Belt), $5^1/_2$ fm., algæ. Young fish trawl on bottom, 10 minutes: 79 cod (0 gr.), 2 larger cod as also other fish.

D. 25—9—02. S. from Skjoldnæs, 17 fm. (western Baltic). Small English trawl, 25 minutes: 115 cod (0 gr.), 3 cod (1 gr.).

Tab. B. List of measurements of cod (0—8 Da. inches) 1902.
(+ means: number not stated)

Centimeters	Inches (Da.)	March		April		May	June				July	August	Septbr.
		Great Belt	Great Belt	Great Belt, Little Belt	Little Belt	Little Belt	Kattegat	Sound	Great Belt	Great Belt, Little Belt	Western Baltic	Great Belt	Great Belt
		intermediate	bottom	intermediate	bottom	intermediate	bottom	intermediate	intermediate	bottom	bottom	bottom	bottom
c.21	8	—	—	—	—	—	—	—	—	—	—	—	3
													2
			1		1							1	
			3									3	2
c.18	7	—	4	—	1	—	—	—	—	—	—	2	4
			6		7								
			3		3							1	1
			1		7								
c.15$_5$	6	—	4	—	6	—	—	—	—	—	—	1	—
			4		6							1	
			6		7								
			6		10								1
c.13	5	—	2	—	5	—	—	—	—	—	—	—	3
			1		5								4
			3		8								6
			2		4								5
c.10$_5$	4	—	—	—	—	—	—	—	—	—	—	—	11
			2		1							1	6
					2								4
													4
c.8	3	—	—	—	—	—	—	—	—	—	—	—	2
c.5	2	—	—	—	—	—	—	—	—	3	1	—	—
						1	2			5			
							3			7			
							2			11	1		
c.2$_5$	1	—	—	—	—	+	7	—	—	11	2	—	—
						+			1	7	2		
						+	1	4	2	1			
		2		+		+		4	3	2			
0	0	—	—	—	—	—	—	—	—	—	—	—	—

If we consider the waters which connect the true Baltic with the Kattegat and which are usually included under the name Belt Sea as one region, we see that *the bottom-stages were only found in the western part of the sea, in 1902 as in 1904.*

In the true Baltic south from Møen, 10—12 fm., numerous bottom-stages

of the cod were taken in July and September 1902. Few investigations were made for the bottom-stages of the cod in the Kattegat in 1902; some hauls with the young-fish trawl on the bottom were made in the northern Kattegat in June and in these not a few of the bottom-stages were taken.

The distribution of the bottom-stages was also for the most part the same in 1902 as in 1904. The most essential difference is this, that *the bottom-stages were much more numerously represented in 1902 than in 1904.*

Tab. C. List of measurements of cod (0—20 cm.), 1903.

Centimeters	Febr.		March	April			May					June								July		August		Septbr.		Octbr.	Novbr.		
	Great Belt	True Baltic	Great Belt	Skager Rak, Kattegat & Great Belt	Great Belt	West. Baltic	Kattegat	Sound	Great Belt	Little Belt	West Baltic	Kattegat	Lim Fjord	Lim Fjord	Sound	Great Belt	West. Baltic	West. Baltic	True Baltic	Great Belt	True Baltic	Great Belt	Little Belt	Kattegat	Great Belt	Kattegat	Great Belt	Little Belt	West. Baltic
	intermediate	bottom	bottom	intermediate	bottom	bottom	intermediate	intermediate	intermediate	intermediate	intermediate	intermediate	intermediate	bottom	intermediate	intermediate	intermediate	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom
20	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	10	—	6	—	7	—	1	1	2	5	16	16
19	—	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—	—	16	—	5	1	6	3	1	2	—	12	18	18
18	—	—	2	—	1	3	—	—	—	—	—	—	—	—	—	—	—	15	—	3	—	4	3	1	—	—	3	13	4
17	—	—	2	—	4	1	—	—	—	—	—	—	—	—	—	—	—	9	—	1	1	2	1	2	1	—	1	8	6
16	—	—	4	—	1	3	—	—	—	—	—	—	—	—	—	—	—	6	1	1	—	3	—	—	—	—	2	13	3
15	—	—	8	—	5	5	—	—	—	—	—	—	—	—	—	—	—	4	—	1	1	2	—	—	—	—	3	17	2
14	—	—	4	—	5	4	—	—	—	—	—	—	—	—	—	—	—	4	—	—	1	—	—	1	—	—	3	18	1
13	—	—	1	—	8	2	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—	1	—	—	1	3	12	5
12	—	2	3	—	1	1	—	—	—	—	—	—	—	—	—	—	—	4	—	1	—	—	2	1	—	1	2	25	8
11	—	—	4	—	1	2	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	1	1	1	—	1	23	9
10	—	—	1	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	6	2	—	—	—	28	5
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	12	4	2	1	—	30	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	6	9	8	1	—	—	7	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	2	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	2	10	1	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	3	—	—	13	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	1 1 3	—	—	—	—	—	2	—	—	7	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	1	—	—	—	3	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	1	—	—	13	—	1	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—
1	—	—	—	1 2	—	—	1 10	2 7	4 2	2 6	2 6	17 39	—	—	5 3	10	—	—	—	—	—	—	—	—	—	—	—	—	—
0	—	—	—	21 —	—	—	3 —	5 —	—	—	11 —	13 —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

In **1903** we found the pelagic cod young already in February, taking 2 small specimens to the S. E. of Sprogø, 25 fm., in a 10 minutes haul with the young-fish trawl on the surface on the 26th. As the young-fish trawl was used but little in 1903, few pelagic cod young were taken in that year, and mostly in May and June (see Tab. 3 A). Nor did we fish much with this apparatus in the autumn. Concerning the distribution of the bottom-stages of the cod in 1903, I can only say that there were many of these in the Little Belt and few in the

Great Belt. The growth of the 0-group in 1903 has been followed by the aid of many measurements, which are given in Tab. C. This Table is constructed in the same way as Tab. D and shows the growth of the 0-group throughout the year. A comparison of Tables C and D shows, that the growth of the 0-group in each month is almost the same in 1903 as in 1904 (Tab. B, p. 28 shows the same for 1902).

If the three lists B—D are taken together, it is seen that in none of the

Tab. D. List of measurements of cod (0—20 cm.), 1904.

Centimeters	Febr.		March		April					May					June							July	August			Septbr.	Octbr.
	North Sea & Skager Rak	Great Belt	Katteg., Gr. Belt, West. Baltic	Great Belt, West. & True Baltic	Skager Rak, Kattegat		Lim Fjord	Great Belt	Skager Rak	Lim Fjord	Kattegat	Great Belt	Little Belt	West. Baltic	Kattegat, Great Belt	Skager Rak, Kattegat		Kattegat	Little Belt	Little Belt	West. Baltic	West. Baltic	True Baltic	Skagerak, Kattegat	Little Belt	West. Baltic	West. Baltic	True Baltic	Little Belt
	intermediate	bottom	intermediate	bottom	intermediate		intermediate	intermediate	bottom	bottom	intermediate	intermediate	intermediate	intermediate	bottom	intermediate		bottom	intermediate	bottom	intermediate	bottom	intermediate	bottom	Algæ or ZosteraGround	Algæ or ZosteraGround	bottom	bottom	Algæ or ZosteraGround
20	—	1	—	4	—		—	—	2	28	—	—	—	—	1	—		1	—	2	—	—	—	—	—	10	—	—	—
19	—	—	—	2	—		—	—	1	19	—	—	—	—	1	—		1	—	3	—	—	—	1	4	9	—	—	1
18	—	6	—	1	—		—	—	2	10	—	—	—	—	—	—		3	—	2	—	—	—	—	—	13	—	—	—
17	—	12	—	—	—		—	—	1	8	—	—	—	—	—	—		—	—	2	—	2	—	1	1	11	—	—	—
16	—	25	—	1	—		—	—	4	4	—	—	—	—	—	—		1	—	4	—	1	—	—	—	2	—	—	3
15	—	34	—	—	—		—	—	1	1	—	—	—	—	—	—		1	—	5	—	—	—	—	—	—	—	—	6
14	—	35	—	—	—		—	—	—	3	—	—	—	—	1	—		—	—	1	—	—	—	1	—	1	—	—	8
13	—	47	—	1	—		—	—	—	2	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	8
12	—	40	—	—	—		—	—	—	1	—	—	—	—	—	—		—	—	—	—	—	—	—	2	—	—	—	12
11	—	32	—	2	—		—	—	—	1	—	—	—	—	—	—		—	—	—	—	—	—	—	1	—	—	—	8
10	—	11	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	2	—	—	—	3
9	—	1	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	11	2	—	—	2
8	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	1	5	3	—	—	1
7	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	2	1	—	—
6	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	1	—	6	7	1	—
5	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	2	—	—	—	5	—	1	19	—	—
4	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	—	1 3	—	—	—	2	—	—	10	—	—
3	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—		—	1	8 5	1 2	—	1	—	—	—	—	—	—
2	—	—	—	—	—		—	—	—	—	—	—	—	1	—	3		5 4	1 —	1 2	2	2	2	—	—	—	—	—	—
1	—	—	—	—	7		—	—	—	—	—	—	2	17	—	12		3	—	2	—	10	—	—	—	—	—	—	—
0	3	—	3	—	152	7	2	—	—	6	60	10	102	—	—	26		—	—	—	—	11	—	—	—	—	—	—	—

years these represent, 1902—04, is there any indication of a year's group under ca. 8 cm. in the autumn, or between the pelagic young and ca. 10 cm. in the spring. The group of ca. 10—20 cm., which appears distinctly in February—March in all three lists, is thus I group. We can therefore conclude from the three Tables, that the cod young *reach a length of ca. 10—20 cm. in the course of a year, and that the growth takes place chiefly in the months June—October.*

In November 1904 we made a very extensive investigation of the stock of cod on the coasts of Funen. Tab. C shows that the catch of the 0 gr. was greatest in the Little Belt, less in the western Baltic and inconsiderable in the Great Belt. Search was only made for the 0 gr. in shallow water on algæ- or Zostera-covered ground, but the search here was very thorough. The small number, c. 15 of 0 gr., taken in the Great Belt is insignificant compared with the numbers taken at the same place in the following spring (see Tab. D, February, Great Belt). In the course of the winter *an inward movement* of the cod young to the coasts takes place, and this happens each winter. This phenomenon, so far as it has yet been explained, has been noted by the Director in Beretning XI of the Danish Biological Station.

In "Eier uud Jugendformen der Ostseefische, I Bericht", E. Ehrenbaum and S. Strodtmann discuss the *German investigations* in the western and true Baltic in *1903*. The investigations were made in February, May and August. In February there were numerous cod eggs in the western and a few in the true Baltic. In May the number had sunk considerably in the western Baltic, but in the true Baltic there were more cod eggs than in February, and a large number occurred especially in the deeper layers of Bornholm Deep in this month (E. of Christiansø, c. 50 fm.). Only a small number of pelagic cod young was found by Ehrenbaum and Strodtmann, all in the western Baltic in May and all small, under 1 cm.

Resumé. *Cod eggs* were found from January to May, in the months March—May practically every-where, in January and February only in the southern waters.

The *pelagic cod young* appear in February to June in all the Danish waters except the true Baltic, where none were take at any time. After June pelagic cod young have never been found, but the *bottom-stages* appear at this time, partly on the algæ- or *Zostera*-covered grounds at the coast, partly on clear ground in deeper water. Even in the pelagic stage the cod young were more numerous in the western part of the Belt Sea than in the eastern, and in the bottom-stage they are restricted to the western part. Thus the bottom-stage was not found at all in the Sound, nor sometimes in the Great Belt with its extensions to the north and south (see chart p. 24), but it was always very frequently represented in the Little Belt and the western part of the western Baltic. The bottom-stages occur in the northern Kattegat and in the true Baltic, but not so many as in the Little Belt and western Baltic. This irregular distribution of the cod young is caused by the hydrographical conditions.

The *cod young grow* principally during the months June—October and in the course of the first year reach a size of ca. 10—20 cm.

Whiting, *Gadus merlangus.*

Investigations in 1904.

We have not detected the **whiting eggs** in Danish waters during 1904.

Pelagic whiting young were first met with when we were in the Skager Rak on the 28th of *April*:

D. 28—4—04 Skaw lightship in S., $1^1/_2$ miles, 40 fm. (Tab. 1, Skager Rak). Young-fish trawl — 12 fm., 25 minutes: 6 young of whiting, all small, many young of other gadoids (see under cod).

This find of whiting young in the Skager Rak stands quite alone amongst the results of our pelagic fishery in April, yet we fished a great deal during this month in the Kattegat right up to near the boundary towards the Skager Rak, as can be seen from Tab. 1.

At the end of *May* and beginning of June the whiting young had a somewhat wider distribution. We then found them both in the Skager Rak and northernmost part of the Kattegat:

D. 31—5—04. Frederikshavn in N. W., 8 miles, 15 fm. (Tab. 1, Kattegat). Young-fish trawl — 12 fm., 30 minutes: 2 *whiting,* ca. 1 cm., as also many other young of fishes.

When we went into the Skager Rak on the following day, 1st of June, we found a large number of pelagic whiting young:

D. 1—6—04. . Skaw lightship in S., c. 60 fm. (Tab. 1, Skager Rak). Young-fish trawl — 40 fm., 40 minutes: 48 *whiting,* the majority $^1/_2$—$1^1/_2$ cm. as also many other young of fishes.

Thereafter we went southwards with the »Sallingsund«, setting our course for the east of Læsø. North of Læsø we took one whiting young:

D. 2—6—04. North Reef in S., 6 miles, 22 fm. (Tab. 1, Kattegat). Young-fish trawl — 20 fm., 15 minutes: 1 *whiting,* $1^1/_2$ cm., as also many other young of fishes.

With this we parted from the whiting young for some time. During the whole of our cruise in the beginning of June through the southern Kattegat, the Sound, true Baltic, western Baltic and Little Belt we found no whiting young. though on the other hand many pelagic cod young (see Tab. 1 for the waters mentioned).

Thus the distribution of the whiting young in April was limited to the Skager Rak, in the beginning of June to the Skager Rak and the northernmost part of the Kattegat.

The next time we met with the whiting young was on the 20th of June in the Great Belt:

D. 20—6—04. Off Hverringe Skov, 4—7 fm. (Tab. 1, Great Belt). Young fish trawl — c. 2 fm., 10 minutes: 1 *whiting young,* 15 mm., no other fish young, ca. 10 *Cyanea cap.,* two of which were large.

Some days later we again took a whiting young in the Great Belt, this time still further to the south, on the boundary to the true Baltic:

D. 28—6—04. Spodsbjærg in N. W. to N., $1^1/_2$ miles, 14 fm. (Tab. 1, Great Belt). Young-fish trawl 9 fm., 25 minutes: 1 *whiting young,* 3 cm. and some other fish young as well as 10 large and many smaller *Cyanea cap.,* ca. 20 *Aurelia,* a few *Pleurobrachia* and *Bolina.*

Some hauls with the young-fish trawl on the bottom, both at these and other stations, gave no whiting young.

Thus, although the whiting young were only found in the northernmost parts of the Danish waters in the beginning of June, we found them at the end of June in the Great Belt, but near the boundary to the true Baltic. They were still pelagic.

We found no whiting young in the western Baltic at the end of June (see Tab. 1, western Baltic, 26 to 29—6).

In *July* we went northwards with the »Sallingsund» through the Kattegat and caught the whiting young almost everywhere, partly in intermediate hauls, partly in bottom hauls, but only single specimens in each haul. As we neared

the Skager Rak, the numbers rose considerably. In the Kattegat north of Læsø and in the Skager Rak there was an extremely large number of whiting young. They were living partly in intermediate layers* over deep water partly at the coasts on algal or *Zostera* covered ground, as the following stations show:

D. 26—7—04. Måseskär in E. to N. $^3/_4$ N., 10 miles, c. 70 fm. (Tab. 1, Skager Rak). Young-fish trawl — 10 fm., 10 minutes: ca. 50 *whiting-young,* 1—6 cm., of other species only 1 haddock young. Young-fish trawl — ca 40 fm., 10 minutes: 6 *whiting-young,* $1^1/_2$—$3^1/_2$ cm., no other fish. Young-fish trawl on blocks on bottom 30 minutes: 6 *whiting-young,* $1^1/_2$—$3^1/_2$ cm., a few other fish young and many other adult fishes.

D. 27—7—04. N. W. from Hirsholm, ca. $1^1/_2$ fm. Young-fish trawl on bottom, 5 minutes: some *whiting-young,* young of *Spinachia, Gasterosteus* etc. with other adult fishes.

D. 27—7—04. Deget in West, 5—8 fm. (Kattegat, north of Frederikshavn, algæ. Young-fish trawl on bottom, 10 minutes: 94 *whiting-young,* $2^1/_2$—10 cm., some other young and adult fishes.

We certainly did not obtain so many whiting young at every station as at those mentioned; but they were seldom absent from our catches to the north of Læsö, wherever we used the young-fish trawl either in intermediate layers over deep water or on the bottom at the coasts.

Both the pelagic young and the *bottom-stages*** of the whiting were thus in the Kattegat at the end of July.

On July 20th we again left the northern Kattegat and went southward. As on the cruise northwards we caught the whiting young in single specimens but almost everywhere, where we fished with the young-fish trawl (see Tab. 1, Kattegat, 28 to 30—7). We continued through the Great Belt down to the western Baltic at Ærø. Here we obtained no whiting young, but some larger whiting, 18—24 cm.

At the end of *August* when we made a short cruise to the western part of the western Baltic we found the whiting young in Fehmarn Belt:

D. 26—8—04. Olenburg Huk (Fehmarn) in W., 3 miles, 14 fm, algæ. Young-fish trawl on bottom, 10 minutes: 1 *whiting young,* 9 cm., no other fish, 4 small *Cyanea cap.,* ca. 10 cm. in diameter.

D. 26—8—04. Staber Huk (Fehmarn) in W. to S., 9 miles. 14 m. (Tab. 1, western Baltic). Young-fish trawl on bottom, 8 minutes: 2 *whiting young,* 12 and 21 cm., some other fish young and older fish. Young-fish trawl — 10 fm., 10 minutes: no whiting young, some young of other species.

At the end of August we thus found *the whiting young in the western part of the western Baltic, but only in the bottom-hauls.*

From the 30th of August to the 3rd of *September* we fished a great deal in the Great Belt with various apparatus at 10—11 fm., but without taking a single whiting young or adult. A haul with the Danish trawl (Petersen's pattern) in 6—7 fm., algal ground, S. from Slipshavn (Great Belt) on the 3rd of September gave however 1 whiting of 8 cm.

In the beginning of September therefore we did not find the whiting young

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* When we were sailing from the Swedish coast to the Skaw on July 27th in perfectly calm weather, we could see from the »Sallingsund« the whiting young playing about under the *Cyanea capilata.*

** In the Lim Fjord we took some whiting young, in all 19 specimens of 5—9 cm., at the end of July. On the other hand we found no cod young there.

in deep water in the Great Belt, but on algal ground near the coast we made a single haul and obtained one whiting young.

Later in September we found the whiting young in the true Baltic and in the Sound, as can be seen from the following journal extracts:

D. 16—9—04. Møen cliffs in W. N. W., ca. 20 miles, 24 fm. (Tab. 1, true Baltic), soft bottom. Young fish trawl on bottom and intermediate, 18 minutes: 1 *whiting*, 12 cm., some *Gobius minutus*, adults and young, no fish otherwise.

D. 17—9—04. Stevn lighthouse in N. W. $^3/_4$ N., 4 miles, ca. 10 fm. (true Baltic), hard ground. Small young-fish trawl ("mud-trawl") on bottom, 5 minutes: 1 *whiting*, 12 cm., some *Gobius minutus* adults and young, no other fish.

D. 18—9—04. S. of Hveen, 5 miles, 10 fm. (Sound), hard ground. Small young-fish trawl on bottom, 5 minutes: 1 *whiting*, 11 cm., otherwise only specimens of various *Gobius species* and *Aphya pellucida.*

D. 18—9—04. N. of Barsebäk, 7—8 fm. (Sound), *Zostera* and algæ. Small English trawl, 30 minutes: 6 *whiting*, 9—12 cm., many adult fishes.

D. 19—9—04. Off Sletten, c. 4 fm. (Sound), 6 *Chorda filum* in quantities. Danish trawl, 10 minutes: 1 *whiting*, 9 cm., many other fishes.

As can be seen from the stations mentioned, *the whiting young were found at the end of September in the true Baltic and the Sound both in deep water and at the coast, but always in bottom-hauls.*

In *October* we took 1 whiting young, 11 cm., in the Great Belt on the 10th, and 2 whiting, 12 and 14 cm., in the Little Belt on the 12th. At the first place the bottom was covered with algæ and the depth was not great, ca. 4 fm., in the Little Belt however the depth at our station was ca. 11 fm.

The few whiting young we took in October were thus found partly in deep water partly at the coast.

Reviewing our catches and non-catches of whiting young throughout the year, we see that the *whiting young were found (1) in April only in the Skager Rak, (2) in the first days of June in the Skager Rak and also Kattegat north of Læsø, (3) at the end of June right down to the south boundary of the Great Belt but no further to the south or east, (4) at the end of August in the western part of the western Baltic, (5) at the end of September in the true Baltic.*

At the same time we find that *the transition to the bottom-stage occurred in July. Before July we could only find the pelagic young and after July only the bottom-stages.*

If we mark out on a chart the limits of the occurrence of the eggs, pelagic young and bottom-stages in 1904, we see that *the whiting during development widens its area of distribution.* This is in direct contrast to the cod, which during development retreats to the north and west.

There must therefore be other conditions which control the distribution of the whiting than those which force the cod young away from the Danish waters or into corners of these. Both species have pelagic eggs and a pelagic stage for the young, and are therefore completely under the influence of the currents in the first period of development, but there is this difference, that the cod eggs appear in the first months of the year, its pelagic young already in February, whereas in 1904 we have not observed the whiting young before the end of April. The cod young are already in the bottom-stage in the course of June; whereas all the whiting young in June and the greater number in July were still pelagic.

Thus the eggs and pelagic youug of the whiting appear later in the Danish waters than those of the cod, and it is this circumstance which determines the distribution. In the section on the cod I have shown, how the eggs and pelagic young of this species are carried away from the intermediate parts of the Danish waters. The cause of this was shown to be the currents, and the bottom-stages were thus lacking in certain regions. On account of the later appearance of the whiting eggs and young, other hydrographic conditions determine their distribution. I shall now describe the progress of these conditions in 1904.

At the end of June a great change in the hydrographic conditions took place. Concerning this I find the following in the journal, noted on June 30th:

> In the second half of June we had a hard north-westerly storm, which brought very salt water right down into the Great Belt. In consequence of this we had an unusually high level of water, which even rendered difficult our investigations of the occurrence of the flat-fish young on the coasts of the Great Belt and western Baltic, and obliged us to go in waist-deep at places where we were accustomed merely to wade. With the salt water came numerous specimens of *Cyanea cap*, and *Bolina*, which we had not previously seen in the Great Belt in summer, became so common as to be a great nuisance in our investigations with the young fish trawl, enveloping the young captured and making the trawl slimy and close.

This appearence of salt water can be distinctly traced by looking at Tab. 1, where the hydrographical changes can easily be followed, e. g. in the Great Belt, by looking down the Table.

We find there:

D. 27—5—04.	S. E. of Sprogø, 20 fm.	Surface salinity $12._6$ $^0/_{00}$
D. 30—6—04.	Off Nordenhuse, 11 fm.	— $15._9$ $^0/_{00}$
D. 28—6—04.	Spodsbjærg in N. W. to N., $1^1/_2$ miles, 14 fm.	— $21._3$ $^0/_{00}$

The two places first named lie in the northern Great Belt, the third in the southern. The great increase observed in the salinity is thus the more striking. An even better notion of the abnormal hydrographic conditions at the end of June will be obtained by looking through the "Nautisk-meteorologisk Aarbog" for 1904. If we take note of the observations made at the lightship of Schultz's Grund, which lies in the southern Kattegat at the boundary to the Great Belt, we find that from the 16th to the 24th of June a strong, westerly wind was blowing, rising to a storm in the later days. From the 17th to the 28th the current was flowing easterly almost continuously, which meant that the Kattegat current was flowing down into the Great Belt. The salinity on the surface rose from $14._7$ $^0/_{00}$ on the 16th to $21._2$ $^0/_{00}$ on the 28th.

As mentioned in my extract from the journal a great quantity of jelly-fishes was found in the salt water. Numerous *Cyanea cap.* were seen near the surface everywhere in the Great Belt and further down in the Fehmarn Belt; deeper down *Bolina* was found, at some places in such great numbers that we could take a netful of them in a 10 minutes haul with the young-fish trawl. These jelly-fishes come with the current from the north. We had not seen them in the Great Belt before the June storms, at any rate no *Bolina* and not so many nor so large *Cyanea cap.* The whiting young followed with the jelly-fishes. At the stations where we took the whiting young in the Great Belt on the 20th and 28th of June, there were many jelly-fishes (see the journal extract given above for the 20th and 28th — 6).

The inflow of salt water which poured from the north into the Great Belt at the end of June 1904 came too late to take the cod young with it. The pelagic young of the cod were still in the Skager Rak on the 1st of June; but when the inflow come, the cod young in our northern waters had already passed over to the bottom-stage.* On the other hand the whiting young were still in the pelagic stage and were therefore carried by the current southwards from the Skager Rak and the northern Kattegat right down through the Great Belt.

The occurrence of the whiting young still further to the south and east later in the autumn, in September both in the Sound and true Baltic, was due partly to the great "inflow" at the end of June partly perhaps to a continued flow** in the same direction, as the young a short time after had passed over into the bottom-stage.

In order, to obtain a view over the **growth** of the whiting young, I have brought together all the measurements of whiting (0—20 ctm.) made in 1904 on to a Table in the same way as for the cod young (see Tab. E.). All the measurements taken in the course of a month in each single region are collected into a list, and these lists are placed on the Table so that the size of the young whiting can be followed from month to month. The whiting taken in intermediate hauls are kept separate from those taken in bottom-hauls. In this way we can see the size of the young living in the intermediate water-layers; on the other hand we cannot conclude that the whiting taken in the bottom-hauls were therefore living on the bottom.

Great difficulties are experienced in following the growth of the whiting young in the waters within the Skaw. The ever changing conditions under which the young grow up whilst they are being carried by the current cause the growth to be very various for the different individuals. The measurements group them-

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* On the 29th of June, the day after we had taken whiting young in the southerly Great Belt, we went to the south and east through the western part of the western Baltic and were constantly meeting many *Cyanea cap.* in the surface layers. We found no whiting young here but on the other hand the cod young, which appeared in similar manner to the whiting young in the Great Belt.

D. 29—6—04. Nysted church in N. E., 10 miles, 6—9 fm (Tab. 1, western Baltic.) Young-fish trawl — 4 fm., 20 minutes: 5 *cod young,* one of which was $3^1/_2$ ctm. with chequered pigmentation, the others smaller, some other fish young, specimens of *Cyanea cap.*

We may consider these cod young, either as stragglers, which had not yet passed over to the bottom-stage as late as June 29th, or as regards those with the chequered pigmentation as having taken up a free-swimming mode of life under the jelly-fishes instead of seeking the bottom.

** If a species living in Danish waters has both a pelagic and a bottom-stage, its pelagic stage comes under the influence of the surface current, the bottom-stages under that of the bottom-current. If these currents have the same direction, they intensity each others influence. Thus in the autumn of 1904 we met the *whiting young* in the true Baltic, because the pelagic young had been carried far down into our waters by the incoming surface-current at the end of June, and when the young later approached the bottom they were again surrounded by water which was flowing inwards in the direction of the true Baltic.

The *cod young* in 1904 were carried northward in the pelagic stage through our waters, borne by the surface-current, but in changing over to the bottom-stage it is quite possible that they also came into the water-masses, which were flowing into the Danish waters along the bottom. In this way some of the cod young, which are carried by the current away from the intermediate areas of our waters, may perhaps gradually return to these.

selves as a rule therefore very irregularly. Yet I am inclined to consider the whiting represented on the Table as belonging only to two years' groups. All the whiting up to 10 cm. in July, and up to ca. 17 cm. in October should therefore belong to the 0 group. This conclusion is strengthened by Tab. F.: lists of measurements of whiting (0--20 cm.) in 1903.

Tab. E. Lists of measurements of whiting (0—20 cm.) 1904.

Centimeter	March	April				May			June						July									August		Septbr.			Octbr.		
	Great Belt	Skager Rak	Skager Rak	Kattegat	Great Belt	Kattegat	Kattegat	Great Belt	Skager Rak	Kattegat	Kattegat	Sound	Great Belt	Little Belt	Gulmar Fjord (Sweden)	Gulmar Fjord (Sweden)	Skager Rak	Skager Rak	Kattegat	Kattegat	Lim Fjord	Great Belt	Great Belt	West. Baltic	Sound	Great Belt	true Baltic	Kattegat	Great Belt	Little Belt
	bottom	intermediate	bottom	bottom	bottom	intermediate	bottom	bottom	intermediate	bottom	intermediate	bottom	intermediate	bottom	bottom	intermediate	bottom	intermediate	bottom	intermediate	bottom	bottom	intermediate	bottom	bottom	bottom	bottom	bottom	bottom	bottom
20	—	—	3	—	—	—	—	—	—	1	—	—	—	1	3	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—
19	—	—	10	—	—	—	—	—	—	1	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	—	—	11	—	—	—	—	—	—	1	—	—	—	—	4	—	—	—	3	—	—	—	—	1	—	—	—	—	—	—
17	—	—	9	2	1	—	2	3	—	3	—	—	—	—	5	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—
16	—	—	11	3	2	—	6	2	—	2	—	4	—	—	3	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—
15	—	—	14	2	2	—	5	—	—	9	—	3	—	—	1	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—
14	—	—	10	3	3	—	3	—	—	5	—	2	—	—	—	—	—	—	2	—	—	—	—	—	—	—	1	—	1	—
13	1	—	7	1	—	—	4	—	—	6	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	9	—	—	—
12	1	—	2	—	1	—	1	—	—	6	—	—	—	—	1	—	—	—	—	—	—	—	—	1	1	—	2	12	—	1	—
11	—	—	—	—	—	—	3	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	10	1	—
10	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	3	—	—
9	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	3	—	—	1	3	—	—	5	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	38	—	4	—	—	—	—	1	—	1	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	37	1	4	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	4	22	5	5	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	1	3	6	1	3	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	6	3	1	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	4	12	3	1	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	4	5	11	3	3	—	—	1	—	—	—	—	—	—	—
1	—	6	—	—	—	2	—	—	+	—	1	—	1	—	—	—	3	7	1	6	—	2	—	—	—	—	—	—	—	—
0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Investigations in earlier years.

In earlier years the whiting young were found pelagic later in the year than in 1904.

In **1891** the Director took pelagic whiting young in Fænø Sound in August and September.

In **1903** we found some pelagic and small whiting young at Sprogø in August.

D. 3—8—03. S. E. of Sprogø, 18 fm. Young-fish trawl — 13 fm., 10 minutes: 1 *whiting young,* ca. 1 cm., some other fish young.

D. 18—8—03. S. E. of Sprogø, 18 fm. Young-fish trawl — 10 fm., 20 minutes: 9 *whiting young,* 1—2 cm., some other fish young, amongst which 1 *Gadus esmarkii,* 1 cm.

D. 22—8—03. S. E. of Sprogø, 18 fm. Young-fish trawl — 10 fm., 10 minutes: 1 *whiting young,* small.

If we seek in the "Nautisk-meteorologisk Aarbog" for an explanation of

the occurrence of pelagic whiting young in the Great Belt in August 1903, we find that a phenomenon occurred in that month similar to what occurred in June 1904. The observations from the lightship at Schultz's Ground in August 1903 show, that a W. N. W. gale was blowing several times in the course of the month, and that the direction of the wind for the whole month was almost continuously

Tab. F. Lists of measurements of whiting (0—20 cm.) 1903.

Centimeter	March	June	August		Septbr.			Octbr.				Novbr.
	Great Belt	Kattegat	Kattegat	Great Belt	Kattegat	Sound	Great Belt	Kattegat	Sound	Great Belt	Little Belt	Great Belt
20	—	1	—	—	—	—	—	1	—	—	—	—
19	—	—	—	—	—	—	—	1	—	1	—	—
18	—	1	—	—	—	—	1	—	—	—	—	—
17	—	—	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—	—	—	2	1	—
15	1	1	—	—	—	1	1	—	1	—	2	—
14	—	—	—	—	—	—	—	—	2	1	1	1
13	—	1	—	—	4	—	2	2	2	1	3	—
12	1	1	—	—	4	1	3	3	1	—	1	1
11	—	—	—	—	12	2	3	13	2	1	—	1
10	—	—	—	—	14	1	1	6	1	1	1	—
9	—	—	—	4	9	—	3	4	—	—	—	—
8	—	—	—	1	8	—	—	9	—	—	1	—
7	—	—	—	—	5	—	—	1	—	—	—	—
6	—	—	—	—	1	—	—	—	—	—	—	—
5	—	—	—	—	1	—	—	—	—	—	—	—
4	—	—	—	—	1	—	—	—	—	—	—	—
3	—	—	1	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—
1	—	1	—	—	—	—	—	—	—	—	—	—
0	—	—	—	—	—	—	—	—	—	—	—	—

westerly (W. S. W. — W. N. W.). The current was almost quite as constantly easterly during the whole month, and the salinity on the surface, which was 14.4 ‰ on August 1st, was 21.8 ‰ on September 3rd.

Our finding the small whiting fry in August 1903 indicates that the whiting has a prolonged spawning period; in 1904 we found the whiting young already at the end of April.

Other Gadoids.

Haddock, *Gadus aeglefinus.*

The haddock was detected in April 1904 on hatching ont some eggs taken on the 23rd in the Læsø Channel (see Tab. 1, Kattegat).

Pelagic haddock young were taken in intermediate hauls in the Skager Rak on *April* 28th (see Tab. 1), to the number of 65; they were quite small.

On the 1st of *June*, when we were again fishing in the Skager Rak (see Tab. 1) the haddock young were larger but still numerous. We took 28 haddock

young, $^1/_2$—2 cm., in a 40 minutes haul in intermediate layers with the young-fish trawl.

Both in April and June we were stationed near the boundary towards the Kattegat, and as we never found the haddock young in the Kattegat in these months the limit to their distribution must have been very sharp.

Nor did we find the haddock young within the Skaw later in the year. Like the cod, it must have been for the most part in the **bottom-stage**, when the June storms caused the great invasion of whiting.

We took a pelagic haddock young in the Skager Rak even at the end of *June*, but it was 7 cm. long (the haul is mentioned in detail under whiting). It was the only haddock young we took in July, though we fished much more in the Skager Rak in this month than in April and June, and though we made both intermediate and bottom hauls. We obtained the whiting young in quantities, but no haddock young apart from the one mentioned. Larger haddock of 22—37 cm. were obtained however in a bottom haul in ca. 60 fm. water. The same must have happened to the haddock young therefore as to the cod young. *During development they have been steadily carried further and further away from the Danish waters.* Haddock eggs were detected in the Kattegat, the tiny fry in quantities in the Skager Rak near the boundary to the Kattegat; the larger fry were found in the Skager Rak but only a single specimen.

When the stock of fish in the Skager Rak and northern Kattegat was investigated in 1897—98 (see Biol. Stat. Beretn. IX), not a few haddock young were taken in July both in the Skager Rak and northernmost part of the Kattegat, north of Læsø; they were ca. 3—4 inches (ca. 8—11 cm.) in length.

Larger haddock of ca. 40 cm. and above are taken by the fishermen now and then in the autumn in the Great Belt.

Norway Pout, *Gadus esmarkii.*

We found the *pelagic young* of the Norway pout in the Skager Rak both on *April* 28th and *June* 1st (Tab. 1), but only in small numbers; in April we took three, all small, in June one, ca. 1 cm.

We also found the young of the Norway pout in the Kattegat in June:

D. 3—6—04. E. from the Flounder Ground, 40 fm. (Tab. 1, Kattegat). Young-fish trawl on blocks on the bottom, 15 minutes: 3 *Norway pout*, ca. $1^1/_2$ cm.

D. 6—6—04. Hesselø in W. N. W., 6 miles, 10 fm. (Tab. 1, Kattegat). Young fish trawl — ca. 9 fm., 30 minutes: 1 *Norway pout young*, many other younfi of fishes.

In 1903 A. C. Johansen took three pelagic young of the Norway pout in the Skager Rak on April 29th.

We also took a pelagic young specimen of the Norway pout in 1903, ca. 1 cm., in the Great Belt on the 18th of August (see under whiting).

The pelagic young of the Norway pout have therefore been found in April, June and August; in April only in the Skager Rak, in June also in the Kattegat and in August even in the Great Belt. *The pelagic young of the Norway pout like those of the whiting penetrate further into the Danish waters during development.*

Plaice, *Pleuronectes platessa.*

Investigations in 1904.

Tab. G. gives a view over the catches of the plaice eggs and young in 1904. The two first parts of the Table, which deal with the eggs and pelagic young, are taken from the summaries for 1904 (see Tab. 2 and Tab. 3 B.) For the eggs, I have only stated if they were found (+), or sought for with the pelagic net but not found (÷). For the pelagic young, it is stated both how many were taken each month in each separate region in intermediate hauls with the young-fish trawl and how long the hauls lasted. The third portion gives information on the occurrence of the bottom-stages in the various regions.

Tab. G. Plaice eggs and young 1904.

		North Sea	Skager Rak	Kattegat		Lim Fjord	Sound	Great Belt		Little Belt	Western Baltic		True Baltic
1. **Plaice eggs.** Pelagic net (+ = eggs found, ÷ = eggs sought for, but not found).													
January		—	—	—		—	—	+		—	—		+
February		—	—	—		—	—	—		—	—		—
March		—	+	+		—	—	+		—	+		+
April		—	÷	÷		÷	—	÷		—	—		—
May		—	—	—		—	—	+		—	+		—
2. **Pelagic plaice young.** Young-fish trawl in intermediate layers.													
March	Nr. of minutes	—	270	715		—	—	42		—	90		85
	» plaice young	—	**0**	**0**		—	—	**2**		—	**1**		**0**
April	Nr. of minutes	—	35	190		70	—	50		—	—		—
	» plaice young	—	**31**	**16**		**0**	—	**0**		—	—		—
May	Nr. of minutes	—	—	170		—	—	275		20	170		—
	» plaice young	—	—	**1**		—	—	**10**		**5**	**103**		—
June	Nr. of minutes	—	60	245		—	30	115		160	130		120
	» plaice young	—	**0**	**1**		—	**0**	**0**		**0**	**2**		**0**
3. **Bottom-stages of plaice.** Shove net (+ = found, ÷ = sought for, but not found).				northern part.	southern part.			western part.	eastern part.		western part.	eastern part.	
April		+	—	+	—	—	—	—	—	—	—	—	—
May		—	—	—	—	—	—	+	—	—	+	—	—
June		—	—	+	÷	—	÷	+	—	+	+	÷	÷
July		—	—	+	÷	—	—	—	—	—	—	—	—
August		—	—	—	—	—	—	+	—	+	+	÷	÷
September		+	—	—	—	—	+	—	÷	—	—	—	÷

Pelagic eggs of plaice were found in 1904 in the months of January, March and May. In *January* we searched for them only in the Great Belt and true Baltic, but found them in both regions though not in great quantity. In *February* no investigations were made. In *March* the plaice eggs were frequent everywhere. On the other hand we found none in *April*. Our investigations in April in the Skager Rak, northern Kattegat and Lim Fjord were made at the end of the month; pelagic eggs were numerous but none of these were of the plaice.

Plaice eggs must all be hatched out before the end of April in our northern waters. It is different however in the western Baltic. We made no investigations

there in April, but all the more in *May* in which month we were stationed three times to the west of Ærø. We found single plaice eggs here, as will be seen from the following extracts from the journal (see Tab. 1, western Baltic).

D. 6—5—04. W. of Skjoldnæs, 18 fm. Here we made a horizontal haul of 10 minutes with the pelagic net on poles, thus near the bottom, and obtained ca. 1000 fish eggs; of these 10 were plaice. We also obtained plaice eggs at the surface on that day.

D. 17—5—04. W. of Skjoldnæs, 18 fm. We were at this time at the same station as on the 6th. Plaice eggs were again found, but only 1 this time; it was taken with ca. 400 others in a horizontal haul, wtth the pelagic net at a depth of ca. 8 fm.

D. 30—5—04. W. of Skjoldnæs, 18 fm. This day we took no plaice eggs.

Plaice eggs were thus found in the western Baltic till far on in May. Tab. G shows that we also found plaice eggs in the Great Belt in May 1904. We only found a single one however, taken on the 4th of May in a 5 minutes horizontal haul with the pelagic net at a depth of 6 fm., S. E. of Sprogø. This haul gave ca. 1000 fish eggs; only one of the plaice.

Pelagic plaice young were taken in 1904 from March—June. There were none in *February* and only three in *March*. This is the same number as was taken of cod young in this month, and the specimens were just as small.

April and *May* are the chief months for the plaice as for the cod, and the varying hydrographic conditions of our waters thus cause an equally indiscriminate distribution of the plaice young as of the cod young. For the young of both species it holds, that the frequency is greatest in the Skager Rak and western Baltic. It has been shown in the section on the cod, that this condition is due to the currents, which carry away the pelagic eggs and young from the Sound and Great Belt with their extensions to the north and south, whilst the deeper water-layers of the western Baltic, which contain the eggs and young, only take part to a slight extent in the movements.

As appears from Table G, we took 166 pelagic plaice young in April and May 1904. Of these 31 come from the Skager Rak and 103 from the western Baltic. In the Kattegat only 17 were taken and in the Great Belt only 10, though much longer time was spent on the investigations in each of these regions than in the Skager Rak and western Baltic taken together.

In *June* still a few pelagic plaice young were taken in our southern waters. We found one in the southern Kattegat at Anholt on June 4th (Tab. 1, Kattegat) and two in the western Baltic on the 10th and 13th of June (Tab. 1, western Baltic).

As a rule however the plaice young have passed over into the **bottom-stage** before the beginning of June. Many cod young are still pelagic in June, so that the pelagic life of the plaice comes to an end earlier than that of the cod. We thus also find the bottom-stages of the plaice earlier than those of the cod. The latter were not taken until June, whereas in 1904 we found the bottom-stages of the plaice already in April.

The distribution of the bottom-stages of the plaice in 1904 will be described elsewhere by the Director. I have however shown in Tab. G in which region the bottom-stages were taken in each single month, and in order that the characteristic distribution might appear in the Table, I have distinguished between the northern and southern Kattegat, between the western and eastern Great Belt and between the western and eastern parts of the western Baltic. It will thus be seen that the

bottom-stages of the plaice were not taken at all during 1904 in the true Baltic, in the eastern part of the western Baltic, in the eastern Great Belt nor in the southern Kattegat. The bottom-stages of the plaice have thus a similar, characteristic distribution to those of the cod, they are absent from the eastern side of the Belt Sea. We certainly found plaice young in the Sound in September 1904, but only a few in comparison with the time spent on the investigations, and we found none there in June.

If we look at Tab. G in order to compare the distribution of the plaice eggs, pelagic young and bottom-stages, we find that *the area narrows as the transition from egg to pelagic young and thence to bottom-stage goes on.* Plaice eggs are found in all the Danish waters, when sought for at the right time, even in the true Baltic. The pelagic young were not found during 1904 in the true Baltic and the Sound*. In the western part of the western Baltic we took one pelagic specimen of plaice; the bottom-stages were only found on the south coast of that region. From the Great Baltic we have in all 12 pelagic plaice young; the bottom-stages were only found on its western coasts. In the southern Kattegat, south of Anholt, we took two pelagic plaice young, the bottom-stages were not found south of a line through Anholt.

To judge from our 1904 investigations, there seems a certain resemblance between the Skager Rak and western Baltic as regards the quantities of pelagic plaice young. The **development** however does not proceed on parallel lines in the two regions, being somewhat later in the western Baltic. This is shown by the later appearance of the eggs, pelagic young and bottom-stages. To illustrate these conditions I may give some journal extracts with the remarks I have noted there whilst the investigations were in progress.

D. 21—4—04. Thyborøn Channel. At Thyborøn to-day after persistent search with the "bobinet" net we succeeded in finding 5 metamorphosed** plaice young, ca. 15 mm. long.

D. 27—4—04. N. of Frederikshavn's harbour. We went out in a small sailing boat to the north of Frederikshavn's harbour and searched for about two hours with the "bobinet" and "half-moon"*** nets, both in shallow water and somewhat deeper from the boat. With the "half-moon" net in ca. 1 foot of water we got one metamorphosed *young plaice*, 11 mm. Of I group we took in all 7 specimens of 5—6 mm. Earlier investigations of the Biological Station have shown, that great quantities of the metamorphosed young plaice can be taken in a short time at this spot in May—June. The single specimen we succeeded in taking may therefore be regarded as a forerunner of the wandering in to the coast, whilst the majority of the 0 group must be still in deeper water, so far that is as they are hatched, which I assume to be the case, as the plaice eggs so numerous in the previous month are not now to be found.

D. 28—4—04. Skaw lightship in S., $1^1/_2$ miles, 40 fm. (Tab. 1, Skager Rak). In two hauls of altogether 25 minutes with the young-fish trawl in intermediate layers down to ca. 12 fm. we took 31 *plaice young*, most of which were still symmetrical, whilst in some the changing over of the eye had begun; the left eye was still on the left side of the head in all however except one of 14 mm. which had the eye on the ridge but still looking to the left. In the same haul was taken a large number of other young, chiefly of cod and haddock. Most plaice were taken

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* Nor did we find pelagic plaice young in the Lim Fjord in 1904 (see Tab. 1, Lim Fjord), though we eagerly sought for them with the young-fish trawl at the end of April. We found no plaice eggs either.

** See footnote p. 18.

*** "Half-moon" net may be regarded as a "bobinet" net without shaft, which is dragged after one in wading or after the boat in depths a little greater.

in the deeper haul. A 10 minutes haul with the young-fish trawl on the surface gave no plaice young.

D. 29—4—04. Aalbæk Bay. Plaice young were sought for at Aalbæk from the shore outwards in deeper water down to 12 fm. We used the net on sandy bottom along the coast were we could wade but without result, and similarly with the "half-moon" net from the boat down to a depth of ca. $1^1/_2$ fm. In 2—3 fm., sandy bottom, a 10 minutes haul on the bottom with the young fish trawl gave 3 *plaice young;* another haul in 3—4 fm., sandy bottom, likewise gave 3 specimens. These 6 specimens were 9—12 mm. long, more or less asymmetrical; only one of them was more pigmented on the right side than on the left, and even in this the metamorphosis of the eye was not yet complete, the left eye being on the ridge and still looking to the left. The plaice young taken gave one therefore the impression of being pelagic, and in order to obtain information as to how far the plaice young were living on the bottom or higher up, we made some hauls at the same spots, i. e. 2—3 and 4—5 fm., with the young-fish trawl on blocks, thus near to but above the ground. No plaice young were taken in these hauls, and all goes to show that the plaice young in 2—4 fm. off Aalbæk were living on or very near to the bottom.

D. 29—4—04. Aalbæk in N. W., 3 miles, 6 fm. (Tab. 1, Kattegat). In a 10 minutes haul with the young-fish trawl on blocks on the bottom we took 11 *plaice young*, 8—12 mm., some of which were symmetrical, others asymmetrical but only a little. Here therefore we took the plaice young a little above the bottom.

D. 29—4—04. E. of Hirsholm, 12 fm. (Tab. 1, Kattegat). Here we took the *plaice young* in a 10 minutes haul with the young-fish trawl on blocks on the bottom, but this time only two specimens, 10 mm. long, both symmetrical. The young-fish trawl on the surface, 10 minutes, and the same net at a depth of 6 fm., 10 minutes, gave no plaice young.

The investigations of the 21st—29th April in the North Sea, northern Kattegat and at an adjacent station in the Skager Rak gave thus the following result:

North Sea.

D. 21—4—04.	Thyborøn Channel; c. 1 foot:	1 metamorphosed *plaice young* on bottom.

Kattegat.

D. 27—4—04.	N. of Frederikshavn's harbour; 1 foot:	1 metamorphosed *plaice young* on bottom.
D. 29—4—04.	Aalbæk Bay; 0—$1^1/_2$ fm.:	no *plaice young.*
—	— 2—4 -	some asymmetrical, but not metamorphosed *plaice young* on or near bottom.
—	— 6 -	some asymmetrical and some symmetrical *plaice young* a litte over the bottom.
—	— 12 -	some symmetrical *plaice young* a little over the bottom.

Skager Rak.

D. 28—4—04.	Skaw light-ship in S.; 35 fm.:	many symmetrical and asymmetrical *plaice young* ca. 12 fm. under surface.

Some of these plaice young were thus still symmetrical, but most were more or less symmetrical, those taken at Thyborøn and N. of Frederikshavn were metamorphosed specimens.

On the North Sea and Skager Rak coasts the transition to the bottom-stage had thus begun at the end of April. Some of the young living at the bottom were not completely metamorphosed.

A short time after the investigations mentioned were concluded, the »Sallingsund« came to the western Baltic, where we took up our station to the west of Skjoldnæs on May 6th, 18 fathoms (Tab. 1, western Baltic) and on the same day investigated the sand banks at Ærø i Søby Bay. The picture of this day's investigations of the plaice young is quite different from the above, as will be seen from my notes in the journal.

D. 6—5—04. Whilst we had had but small takes of animal plankton in the Skager Rak, northern and eastern Kattegat and Great Belt, such a large quantity of young *Aurelia*, in size from a farthing to a half penny, as also *Sarsia* appeared to-day in the western Baltic, that each haul with the young-fish trawl in intermediate layers gave several liters. Many *Sagitta* and *Pleurobrachia* were also present. We got the impression that these forms, which are carried out and in the Belts by the currents, are here collected together. It is also possible, that when they are brought from the Great and Little Belt into the 10—20 fathoms deep basin west and south from Ærø, they sink down into the deeper, salt layers, which are almost stationary (see p. —), and the surface-current which is not sufficiently salt to support them, passes over them.

As with the jelly-fishes, so with the *fish-eggs*. Many eggs were taken to-day, and they are accustomed to remain here until the young appear. as they are at liberty to hatch out without being carried away as in the Belts. Thus we also found many *fish young* to-day, amongst others the plaice young. As examples may be given:

W. of Skjoldnæs, 18 fm. Young-fish trawl — 3 fm., 10 minutes: 14 *plaice young*, from 6 mm. (with yolk-sac) to 9 mm., as also many other fish young. Young fish trawl — 16 fm., 20 minutes: 11 *plaice young*, all symmetrical, as also many other fish young.

The whole of the pelagic life was further back in development than what we had found to be the case in the northern Kattegat. In the latter region the *Aurelia* young were throughout larger, and we found no plaice eggs, whilst here we took several*, certainly with advanced embryos. In the western Baltic all the plaice young were symmetrical, some even with yolk-sac.

In Søby Bay we searched both with the "bobinet" net wading and the "half-moon" net towed after the boat in a little deeper water. The bottom here was of fine sand, but no plaice were taken, either of the 0 or I-group.

There is thus a great difference in the plaice young we met with at the end of April in our northern waters and those we found in the beginning of May in the western Baltic. On the coasts of the North Sea and Kattegat metamorphosed young were already found before the end of April; we found none in the western Baltic even on the 6th of May. Both in the Skager Rak on April 28th and in the western Baltic on May 6th we found many pelagic plaice young; but it was only in the Skager Rak that some of them were asymmetrical, whereas the eggs of the plaice were only found in the western Baltic.

The plaice young in the beginning of May are thus much further back in development in the western Baltic than in the northern Danish waters.

On May 17th 1904 we were again stationed to the west of Skjoldnæs, 18 fm. (see Tab. 1, western Baltic). On this day I have noted in the journal.

D. 17—5—04. Many pelagic plaice young were found here at Ærø on May 6th. The question is now, whether these have begun their metamorphosis and have approached the coast.

As before, we made some intermediate hauls with the young-fish trawl to the west of Skjoldnæs, and we again got some *plaice young*, all of which were small, but little larger than those taken on the 6th, and they were all symmetrical.

A vertical haul with the pelagic net gave, as mentioned earlier, 88 eggs, amongst which one plaice egg.

In Søby Bay we sought without result for the plaice young on the sands at the coast, in ca. I foot and also a little deeper water to $1^1/_2$ fm.

The plaice young are thus not much further on in development than on May 6th. In other regards also the pelagic life recalls that of 6th. *Sarsia* and *Aurelia* were to-day again extremely numerous in intermediate water-layers, the specimens of the latter were somewhat larger than before.

The hydrographical conditions were almost as on May 6th.

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* Our finding of the plaice eggs in the western Baltic on the 6th of May is mentioned above p. 41.

On the 30th of May we were again at the same spot in the western Baltic as on the 6th and 17th. Immediately afterwards we went northwards with the »Sallingsund« and investigated the condition of the plaice young in the Skager Rak and northern Kattegat on the 1st and 2nd of June.

By this means we again had proof of the great advance in development, which the plaice young in the northern Danish waters show over those in the western Baltic.

On May 30th I note in my journal:

D. 30—5—04. To-day we again took many pelagic *plaice young* to the west of Skjoldnæs. They were taken in intermediate hauls with the young-fish trawl and were all symmetrical. In a vertical haul with the pelagic net we got 84 eggs, none of which were plaice.

In Søby Bay we were successful this time in our search for the young plaice. With the "bobinet" net we took in ca. 1 foot of water 1 *metamorphosed plaice young* in which the eye had just completed the migration. In deeper water with the "half-moon" net towed behind the boat we caught 2 *plaice young*. Of these one was strongly pigmented on the right side, the eye had just completed its migration. In the other the left eye was on the ridge, and there was but little difference in the pigmentation of the two sides. They swam in a slanting position when put into a basin.

The plaice young at Ærø were thus at the end of May at a similar developmental stage to those of the northern Kattegat at the end of April. In the northern Kattegat development was therefore a whole month in advance, and when we took them there in the first days of June they had with a single exception completed metamorphosis.

D. 1—6—08. Skaw light-ship in S., 60 fm. (Tab. 1, Skager Rak). Young-fish trawl in intermediate layers — 40 fm., 40 minutes: no plaice young, many young of other species, e. g. long-rough dab, dab, a few flounder. Young-fish trawl on blocks on the bottom, 20 minutes: a few fish young, no plaice. Young-fish trawl on bottom, 15 minutes: many adult fishes, 4 bottom-stages of long-rough dab.

We thus did not find the plaice young again in the Skager Rak, where they were so numerous on April 28th.

We then searched the coast in Aalbæk Bay with the shove-net. No plaice young were taken, but the coast was exposed to storms and the action of waves and therefore little suited as an abode for the young plaice (see "Biol. Stat. Beretning XII", p. 6: "Yngelens Udbredning ved Kysterne").

We then went out to deeper water:

D. 1—6—04. Off Aalbæk, 2—4 fm., sandy bottom. Young-fish trawl on the bottom, 2 hauls of 10 and 15 minutes: 11 *plaice young*, 12—18 mm. These were all metamorphosed except one, which however was asymmetrical.

Next day we found to the north of Frederikshavn's harbour a numerous stock of metamorphosed plaice, 1—2 cm., which must have wandered in since April 27th, as we the found but one though we searched two hours (see above).

On May 30th when we left the western Baltic the movement of the metamorphosed young to the coast had just begun. In June we again paid a visit there in order to follow the fate of the young plaice. The day's investigations read as follows in the journal:

D. 13—6—04. In deep water W. of Skjoldnæs we took to-day a *pelagic plaice young* in an intermediate haul with the young-fish trawl; it was symmetrical.

In Søby Bay we took 4 *plaice* of the 0 group, $1^1/_2$, $1^1/_2$, $1^1/_2$, $3^1/_2$ cm. in the "bobinet" net.

In deeper water of ca. 1 fm. we made a haul with the "half-moon" net and got two *plaice* of the 0 group, 1, $1^1/_2$ cm.

The metamorphosis was thus not quite completed at Ærø in the middle of June. There were still some pelagic plaice young in the intermediate layers over deep water.

From our investigations of the plaice eggs and young in 1904 it appears, that *the development in the western Baltic is a month behind that in the northern Danish waters.*

It must be clear to those who have followed our investigations at Ærø, that we took no assymmetrical young there in the intermediate layers over deep water, though we found the metamorphosed young at the coast. If we put all the plaice young taken in the western Baltic in a row, arranged according to their stage of development, we find there is a gap in the row. The young taken in deep water are all symmetrical, whilst those found at the coast are quite or almost quite metamorphosed. The transition stages are wanting. If we now form another row of the plaice young taken in the northern Kattegat and Skager Rak during 1904, we find all the transition stages represented there. Considering the whole record, we see that a part of the row comes from Aalbæk Bay, 2—4 fm., at the bottom. From this locality we have an unbroken series of developmental stages from the beginning of asymmetry to complete metamorphosis.

In thus appears, that *the plaice young can pass through all the transition stages from the earliest asymmetry to the completely metamorphosed stage, in the neighbourhood of the coast on or near the bottom.*

This result is confirmed by our investigations at Kerteminde on May 19th. Concerning these I find the following notes in the journal:

D. 19—5—04. We found to-day at Kerteminde a few plaice young on the coast in ca. 1 foot of water. We used the "bobinet" and "half-moon" nets and searched for ca. 1 hour. In the latter net we caught 2 plaice of the 0 group, the smallest 13 mm.; in both the wandering of the eye was completed.

In the "half-moon" net towed after the boat in $^1/_2$—2 fms. we got no plaice young: but the spread of this net is not very wide (ca. 1 meter), and we cannot expect to find the plaice young so densely distributed in deeper water as near the shore, where they crowd together gradually on wandering in. The young-fish trawl was therefore used from the »Sallingsund« in as shallow water as the steamer could come in to. We made 9 hauls altogether each of 7—8 minutes. The hauls began in 7—8 feet of water and were carried out to ca. 2 fm. We succeeded in taking some of the few *plaice young* to be found at this depth — in all 7. Of these 2 were almost metamorphosed; the right side of the body was strongly pigmented and the crossing over of the eye was almost complete. In 4 the left eye was on the ridge. 1 was still symmetrical.

At Kerteminde (Great Belt) we thus found the transition stages at the bottom at a short distance from the shore, as in Aalbæk Bay.

In the Great Belt the developmental stage on the 19th of May was almost the same as on the 29th of April in the northern Kattegat and on the 30th of May in the western Baltic.

Investigations in earlier years.

In order to obtain a more complete picture of the occurrence of the plaice eggs and young than the investigations of 1904 can give, we may consider the results of the investigations of earlier years.

In **1892** the Director found plaice eggs in January—April in Fænø Sound in the Little Belt.

On investigation of the plankton-samples collected in the years **1899—1901** it was found, that plaice eggs occurred in the months November—April, but in November and December only in the southern parts of the Danish waters. The pelagic eggs taken in November and December were all plaice eggs, smaller eggs occurred even in January.

In **1902** very extensive investigations on the distribution of the bottom-stages were carried out. The Director has discussed these investigations in the Biol. Stat. Beretn. XII, and I shall therefore only give a short extract from a report, which Joh.s Schmidt, who was then assistant at the Biological Station, made on the investigations of the distribution of the plaice young (0 group):

"— — — — — in the beginning of September 1902 we succeeded in proving the undoubted presence of specimens of the 0 gr. in deep water, $10^1/_2$ fm., in the Baltic, namely, S. of Møen with Hestehoved in the N. $^1/_2$ W., on hard sandy bottom with Mytilus, where we took 16 in the Danish trawl along with specimens of the I group and older stages as well as a young flounder of 24 mm. and a young dab of 30 mm. In connection with this it may be mentioned that I caught a young plaice of scarcely 2 inches with the Danish trawl on the 23rd of July 1902 in the Baltic at Kriegers Flak (9—10 fm., Møen lighthouse in W. $^1/_2$ S., Mytilus ground)."

It will perhaps be remembered, that I mentioned on p. 28 that many cod young in the bottom-stage were taken in 1902 to the south of Møen. I sought for the explanation of this occurrence in the hydrographical conditions and showed, than the salt bottom-water, which pushes from the western out in to the true Baltic, must carry with it the pelagic eggs and young. It is not excluded therefore, but rather probable, that the specimens of the 0 group, which are now and then found in the true Baltic near Møen, are brought by the current from the west, though we cannot determine at what stage of development this occurs.

In **1903** we took one plaice young in the Great Belt on February 26th and another on March 16th. Both of these were quite small; but a pelagic young plaice in which the migration of the eye had begun was sent to us at Copenhagen even in the beginning of February. This specimen was taken in the large well in the working room of the Biological Station, where workmen are engaged in the winter with the preparation of apparatus and where there is a lighted stove each day. We took no asymmetrical young in the sea either in February or in March.

In 1903 we found a few pelagic plaice young in the true Baltic:

D. 25—4—03. Hestehoved in W. N. W., $4^1/_2$ miles, $12^1/_2$ fm. Pelagic net on pole, 10 minutes: 4 *plaice young*, small, a few other fish young.

These specimens of young plaice were probably carried by the current into the true Baltic, as there were no plaice eggs south of Møen in March 1903 (see p. 14). It appears from the "Nautisk-meteorologisk Aarbog", that in the period from the 20th to 21th April 1903 much salt water (to 15.4 $^0/_{00}$ in 11 m. depth) was carried past the Gedser Reef ligtship into the true Baltic. The plaice young perhaps came with this water.

During the **German investigations in 1903** Ehrenbaum and Strodtmann found numerous *plaice eggs* in the western Baltic in February, fewer in the true

Baltic. In May we took a few in the western Baltic, none in the true Baltic. Of *pelagic plaice young* the German investigators found 2 in February in the western Baltic, one of which "sogar schon in Metamorphose begriffen zu sein schien (sie war stark beschädigt)". In May they found pelagic plaice young in the western Baltic and a single specimen in the true Baltic between Sassnitz and Trelleborg. They were all "jugendliche Formen" except one from Station II (between Als and Ærø), which was "im Stadium der Flossenstrahlenbildung". After discussing these catches of plaice young Ehrenbaum and Strodtmann remark (l. c. p. 87): "Es erscheint demnach wünschenswert, in der zweiten Hälfte des März oder in April nach Schollenlarven in der Ostsee zu fischen, um mehr Klarheit über deren Verbreitung zu gewinnen. Für die Zeit ihrer grössten Häufigkeit ist der Februar wohl zu früh, der Mai wohl zu spät gewesen."

In this I can by no means agree with the German investigators. It appears from Tab. I, that we have only taken one pelagic plaice young in the western Baltic in March 1904 with the young-fish trawl*, though we made not a few hauls with this apparatus at the end of March. On the other hand we found the plaice young in rich quantities in the western Baltic in May, and they were very small in the beginning of the month, as I have remarked above in my extracts from the journal.

We also investigated the true Baltic at the end of March:

D. 18—3—04. Hestehoved in W. N. W., 4 miles, 12 fm., young-fish trawl on blocks on the bottom, 10 minutes: no plaice young, 21 other fish young.

D. 19—3—04. Møen Cliff in W. N. W., 20 miles, 23 fm. Young-fish trawl ca. 2 fm. under the surface, 10 minutes: no plaice young, 40 other fish young. Young-fish trawl — 10 fm., 10 minutes: no plaice young, 25 other fish young. Young-fish trawl on blocks on the bottom, 20 minutes: no plaice young, 7 other fish young.

etc. etc.

At the end of March 1904 therefore we found no plaice young in the true Baltic at Møen, and to judge from our results in the other regions in 1904, May should certainly be the best month in the southern Danish waters to search for the pelagic plaice young. If the German investigators found but 1 plaice young in the true Baltic in May 1903, this means, that the pelagic plaice young were very scarce there in 1903.

Resumé. *Plaice eggs* occur in the Danish waters in the months November —May; they are found in all Danish waters. *Pelagic plaice young* are taken from February—June. They are always extremely few in number in the true Baltic and in 1904, apart from the North Sea, were only abundant in the Skager Rak and the western part of the western Baltic. The *bottom-stages* appear in April. They have a south and east boundary to their distribution. This boundary changes from year to year, but always excludes the true Baltic and a greater or less part of the Belt Sea. Exceptions from the rule can indeed occur, and the bottom-stages of the plaice may be found in the true Baltic, but usually in deep water, ca. 10 fathoms. In the Lim Fjord the bottom-stages are only found at the openings to the North Sea and Kattegat.

* On 23—3—04, Skjoldnæs in N. E., 19 fm., we took a small plaice young in a haul with the pelagic net.

The *development of the plaice young* in the northern Danish waters in 1904 was about 1 month in advance of the development in the western Baltic at Ærø.

In 1904 we have so to speak found the plaice young in all stages of *metamorphosis*. And this shows, that metamorphosis can proceed at or near the bottom in the neighbourhood of the coast.

Flounder, *Pleuronectes flesus*.

In our 1904 collections no distinction was made between the eggs of the flounder and those of the dab. As regards the time and place of appearance of the flounder eggs, we must therefore be content to say, that the *flounder-dab* eggs are found so to speak everywhere in the Danish waters where we sought for them in the months of March—August (see Tab. 2).

Pelagic flounder-young were taken by us in 1904 in April—June.

We took them the first time at the end of *April*. We went from Nyborg on April 13th through the Great Belt and Kattegat with a detour into the Lim Fjord. On the way we used the young-fish trawl a great deal but found no flounder young. It was only on April 28th, when we were in the Skager Rak (see Tab. 1), that we found a few, in all 3. When we again turned southwards through the Kattegat, we found the flounder young everywhere, but they were small.

In *May* we found many flounder young and almost equally many everywhere. Whereas the plaice young in April and May were especially numerous in the Skager Rak and western Baltic, this was not the case with the flounder young (see Tab. 3 B). On the contrary but few were taken in the Skager Rak, and the western Baltic gave nothing in comparison with the other waters.

In *June* pelagic flounder young were still found, but not many, and at the end of the month the pelagic life was quite over.

The **bottom-stages** were first found on June 7th at Anholt harbour. From the middle of June onwards we met the bottom-stages of the flounder so to speak everywhere where we made investigations, yet as a rule only where the salt water was somewhat mixed with fresh from outlets. There is no boundary for the flounder young in our waters as for the plaice, which separates the regions where the bottom-stages are found from those where they are not found.

The reason for this difference in the distribution of the bottom-stages of plaice and flounder is, that the flounder young are not so dependent during development on the salinity of the water as the young plaice are. Further the eggs and young of the flounder appear later in the year than those of the plaice. We found the plaice young even in March, whilst the flounder young were first taken at the end of April. The warmth of the water increases considerably from month to month in the spring, and the hatching of the eggs and the further development proceeds more quickly in consequence for the flounder than for the plaice. The currents have thus not the same amount of influence on the flounder eggs and young as on those of the plaice, and are also perhaps less strong during the pelagic life of the flounder than during that of the plaice (concerning these conditions see "De danske Farvandes Plankton i Aarene 1898—1901", I. p. 250).

All the flounder young we have taken in intermediate hauls were symmet-

rical. The *transition stages* between symmetrical and metamorphosed young were found at the same localities, where we found the transition stages of the young plaice. We took them first on May 19th.

When we found the transition stages of the plaice (see under plaice) on May 19th off Kerteminde in ca. 1—2 fm. water (Tab. 1, Great Belt), we got 10 flounder young at the same time. Of these some were symmetrical or almost symmetrical, in others the wandering of the eye was so far advanced that the eye was on the ridge. They were taken in the young-fish trawl on the bottom and were probably living on or near the bottom.

On the sandy banks at the shore, where we found 2 metamorphosed plaice young, there were no flounder young.

The flounder young at Esbjerg were at the same stage of development as those of Kerteminde at the same period. Om May 21th, Dr. Garstang's assistants took a number of plaice and flounder young there, when the English investigation-steamer »Huxley« lay in the harbour. The plaice young were metamorphosed but those of the flounder not completely; some were almost quite symmetrical, in others the eye was on the margin of the ridge. They were taken with the hands in quite shallow water; there must have been numbers of them.

On May 30th we sought for the flat-fish young in Søby Bay (see under plaice). By wading in we took a metamorphosed plaice young in the "bobinet" net and a flounder young in the "half-moon" net, which was but little pigmented and was swimming obliquely, the one eye on the ridge.

On June 1st off Aalbæk, 2—4 fm. (see under plaice), we took 11 plaice and 4 flounder young as also the young of other fish in two hauls with the young-fish trawl on the bottom. One of the flounder young was asymmetrical, the others symmetrical.

Thus there *does not seem any marked difference in time for the beginning of metamorphosis in the northern and southern Danish waters.* In the second half of May we found the transition stages in the western Baltic and Great Belt and on June 1st in the northern Kattegat.

We still found flounder young, which were not fully metamorphosed, on June 14th at Agernæs and on June 20th at Kerteminde. At Kerteminde we first of all searched on the sand in shallow water with the shove-net and found a number of metamorphosed flounder young. Then we fished from the »Sallingsund« with the young-fish trawl on the bottom in 1—2 fm. water. In two hauls, each of 10 minutes, we took 11 flounder young, one of which was symmetrical, the others metamorphosed or in transition stages.

The transition stages of the flounder were thus at Kerteminde on the bottom near the coast in depths of ca. 1—2 fm. both on May 19 and June 19th. The same rule holds good on the whole for the flounder as for the plaice young: *metamorphosis may occur on or near the bottom in the neighbourhood of the coast.*

Dab, *Pleuronectes limanda.*

What has been said regarding the flounder *eggs* holds good for those of the dab. We have not distinguished between the two species and can therefore

only say, that in 1904 flounder-dab eggs were found so to speak everywhere where we songht them, from the Skager Rak to the true Baltic, in the months of March—August.

In 1904, *pelagic dab young* were taken in the Danish waters during six months of the year, namely *April—September* (see Tab. 3 B). We found them everywhere from the Skager Rak to the true Baltic, most however in the northern parts of the Danish waters. They were by far the most abundant of the pelagic flat-fish young. Thus in June we took 755 pelagic dab young; more than we had taken of all other flat-fish together in the whole year 1904.

In *May* the dab young were small. In the beginning of *June* we found larger specimens, 12—13 mm., with the wandering of the eye just begun.

The **bottom-stages** were first taken on July 11th:

D. 11—7—04. At Schultz's Grund lightship, 20 fm., hard bottom. Young-fish trawl on the bottom, 10 minutes: 4 *dab young*, 1 of which at 13 mm. was metamorphosed and 1 at 12 mm. had the eye on the ridge, as also some adults.

Next day we sought for the bottom-stages of the dab on soft bottom:

D. 12—7—04. Anholt lightship in N. W. to W., $5^1/_2$ miles, 21 fm., soft ground. Young-fish trawl on bottom, 10 minutes: 17 *bottom-stages of dab*, 12—13 mm., also 20 young of long-rough dab in bottom-stage and many other fish.

Thus the dab young had begun to pass over to the bottom-stage shortly before the beginning of May.

From now onwards we searched a great deal for the bottom-stages of the dab at the same time as we were seeking for the bottom-stages of the cod, see the chart p. 24 During these investigations we used the young-fish trawl on the bottom, but as it appeared that the apparatus usually went too lightly over the ground, we shortened the lines from the trawl to the boards, so that in passing over the ground the boards could stir up the bottom-material into the trawl. It was thus often filled with bottom-material, especially when we fished on soft ground, and it is on this kind of ground that the dab young are usually taken. To bring the trawl inboard over the railings, when it comes up from the bottom full of mud, is in so wise practical and we therefore steamed under half-power, when we had hauled so far in that the trawl was hanging along the side of the ship. In this way we washed out all that could go through the stuff of which the trawl is made, and the metamorphosed fish young could then be readily found in the remainder. In order to protect the young-fish trawl, which suffered a good deal on using it in this way, the Director had a special trawl made for this work: the "mud-trawl", which was smaller and easier to handle when full of bottom-material. The "mud-trawl" is only to be considered as a smaller edition of the young-fish trawl.

The bottom-stages of the dab have only been detected in 1904 in the deepest parts of each of the regions. This holds at any rate for the southern waters. In the true Baltic we did not find the bottom-stages of the dab during 1904, in the western Baltic we took only 2, one in 20 fathoms on August 4th, the other in 15 fathoms on August 26th. This catch is small in comparison with the many hauls we made there.

In the northern part of the Little Belt, north of Funen, we took 9 bottom-

stages of the dab on October 12th. We found them in 11 fathoms water, that is, in a basin surrounded by the 10 fathoms curve (see chart).

In the Great Belt in spite of a great deal of searching we only once found the bottom-stages of the dab. This was on November 3rd at a station to the west of Vresen in the 8—12 fathoms deep basin between the grounds at Vresen on the one side and Funen on the other. We got there 2 bottom-stages of the dab in a 10 minutes haul with the young-fish trawl on the bottom.

We made many hauls at various places in the Kattegat and at various depths, as will be seen from the chart. We got a few bottom-stages of the dab nearer the coast than the 10 fathoms line, but only a few. Most were taken at about 20 fathoms.

In October 1904 A. C. Johansen found many bottom-stages of the dab in the North Sea in ca. 10—20 fathoms, and earlier in the spring he took them in great number in Aalbæk Bay in less than 10 fathoms.

Thus in 1904 *whilst we found numerous pelagic dab young in the waters within the Skaw, the bottom-stages were rare in shallower waters than 10 fathoms.* The bottom-stages were very few in number in the Belt Sea and in the true Baltic we found none at all.

Long-rough dab, *Drepanopsetta platessoides.*

Eggs of the long-rough dab were found during 1904 in *March* in the Kattegat and true Baltic (see Tab. 2), Our information as to their occurrence in the Kattegat comes from A. C. Johansen, who took not a few eggs of this species in the northern Kattegat at the end of March on his spring cruise with the "Thor" (see Tab. 1, Kattegat). The discovery in the true Baltic, where adult long-rough dabs are never found, may well cause some surprise and may therefore be mentioned in more detail.

On March 20th we were returning with the "Sallingsund" from the true Baltic making for the south of Gedser, but before leaving this region we took up a station in the W. S. W. of Gedser lightship, 4 miles away, 12 fm. (Tab. 1, true Baltic), thus on the boundary of the western Baltic. Here we made several vertical hauls from various depths with the pelagic net and found, that in the upper 9 fathoms there were no fish eggs; when we sank the net down to a depth of at least 10 fathoms, however, we got a few. We then made a horizontal haul with the pelagic net on a pole, thus in ca. 1 fathom's distance above the bottom. We took ca. 100 eggs in 10 minutes, most of them plaice but a few long-rough dab. The salinity at the surface was 7.3 $^0/_{00}$, at the bottom 16.7 $^0/_0$. The surface-water originated in the true Baltic, the bottom-water from the westward. This is evident from the following scheme, which is an extract from Tab. 1, true Baltic and western Baltic:

		Fv.	°C.	‰
18—3—04.	Hestehoved in the W. N. W., 4 miles, 12 fm., true Baltic.	0	1.4	7.4
		12	1.6	14.7
20—3—04.	Gedser lightship in the W.S.W., 4 miles, 12 fm., boundary between the true and western Baltic,	0	1.4	7.3
		12	1.4	16.7
22—3—04.	Staber Huk in the W. to S. ½ S., 8 miles, 14 fm., western Baltic.	0	2.2	13.1
		14	1.4	16.5

At the Gedser station, where we found the eggs of the long-rough dab, the surface-water had thus the same temperature and salinity as at the station in the true Baltic (S. of Møen), whilst the bottom-water had the same temperature and salinity as at the station in the western Baltic (S. of Lolland). The eggs of long-rough dab, found at the bottom in the salt water, must therefore be considered to have come with the bottom-current from the western Baltic.

This explanation seems the more natural, as we found the long-rough dab in full process of spawning in the western Baltic some days later:

D. 23—3—04. Bagenkop (Longland) in N. E. to N., 3½ miles, 11½ fm. Small English trawl, 2 hauls of 30 minutes in all: 5 *long-rough dab*, two of which were females, 33 and 38 cm., three males, 16, 20 and 25 cm. All these had *running roe and milt*. Many other fish were taken at the same time.

These were not the only spawning long-rough dabs we took in the western Baltic in March 1904. We also found both females with running roe and males with running milt to the west of Ærø. That we did not observe the eggs of long-rough dab in the western Baltic in March, is probably due to the fact, previously mentioned, that few determinations of eggs were made during our March cruise with the »Sallingsund«.

The *pelagic young of the long-rough dab* were found in 1904 (see Tab. 3 B) practically in all the Danish waters, where we sought for them in *April*, *May* and *June*, but not in the Lim Fjord nor in the true Baltic.

We found them the first time on April 13th in the Great Belt (see Tab. 1) quite small, and all the young of long-rough dab we took in April, from the Great Belt, Kattegat and Skager Rak were small.

Asymmetrical young of the long-rough dab were met with late in May:

D. 31—5—04. Light buoy on Tangen in S. S. E., 11 miles, 7 fm. (Tab. 1, Kattegat). Young-fish trawl on blocks on bottom, 10 minutes: 5 *young of long-rough dab*, one was asymmetrical with left eye on the ridge and right side more strongly pigmented than the left; it was 20 mm. long.

Similar young of long-rough dab were also got in the Skager Rak and eastern Kattegat in the first days of June.

The bottom-stages were first taken on July 12th at Anholt in 21 fathoms (see under dab). We took there 20 young long-rough dab, 2—2½ cm., in a 20 minutes haul with the young-fish trawl on the bottom. This must be a good locality, as, when we again fished here on July 28th, we got 34 young of long-rough dab in the bottom-stage in 10 minutes.

The same rule holds for the bottom-stages of the long-rough dab as for those of the dab, namely, that they live in deep water, but the young of the long-rough dab seem to seek even deeper water than the dab young. In 1904 we

did not find them in less than ca. 20 fathoms water, except for a single specimen, 6—7 cm., taken north of Funen in 11 fathoms on October 12th. On the other hand we found the young of the long-young dab in deeper water than the dab young, as for example in the Skager Rak:

D. 26—7—04. Skaw lightship in S. W. $^1/_4$ W., 4 miles, 60 fm. Small English trawl, 45 minutes: 12 *long rough-dab*, three of which were *young*, 3, 3 and $3^1/_2$ cm.; also, many other fishes.

As the bottom-stages of the long-rough dab thus only occur in deep water, their distribution in Danish waters is very limited. In sufficiently deep water, ca. 30 fm. and soft bottom, however, we have seldom sought for the bottom-stages without result. We have found them even in the western Baltic:

D. 17—8—04. W. of Lyø, 20 fm., soft bottom. Young-fish trawl on bottom, 5 minutes: 6 *long-rough dab*, 4 of which were young, $2^1/_2$—4 cm.

2. Species with demersal eggs.

Common sea-scorpion, *Cottus scorpius*, and **Long-spined sea-scorpion** *Cottus bubalis*.

In the spring of 1902, when investigations of the pelagic life were being carried on by the Biological Station in Fænø Sound and neighbouring parts of the *Little Belt,* some attention was at the same time paid to the determination øf the **spawning-period** of our two species of Cottus and their other biological characteristics. This was so much the simpler as a large number of both species at all sizes occurred in the neighbourhood of "Stationen's" anchorage, so that we were able to collect a good material by the aid of various apparatus. Johs. Schmidt, who was assistant at the Biological Station in 1902, gives a description of these investigations in the journal, and I shall keep in the main to his description in giving an account of the spawning of the two species of sea-scorpion.

D. 3—4—02. Fænø Sound. One *longspined Cottus*, placed in the well at the Station has spawned there.

A description of the appearance and size of the eggs is added in the journal, but as Ehrenbaum in "Eier und Larven von Fischen der deutschen Bucht III. Fische mit festsitzenden Eiern" (Wissensch. Meeresunt., Neue Folge, VI Band, Abt. Helgoland, Heft 2, 1904) has given a description of the eggs of *Cottus bubalis*, I find no reason for publishing Johs. Schmidt's description, which would be almost a repetition of Ehrenbaum's.

D. 1—5—02. At Fænø. Fishing for Cottus with seines and hooks. Result: ca. 50, only two of which were the *long-spined Cottus*, the remainder the *common Cottus*.

D. 6—5—02. At Espenhoved at below Hindsgavl, $^1/_8$ fm., shrimp shove-net and trawl. A number of *small Cottus* (2—4 inches) of *both species*, most long-spined species, were taken.

D. 7—5—02. Searched the *Fucus* clumps at Fænø Kalv with the shrimp shove-net. Some specimens of the *long-spined Cottus* were taken; also, eggs of the same species.

D. 9—5—02. Off Anker S. of Fænø. Cottids (almost exclusively the long-spined species) were taken here at low water in the *Fucus* with shrimp shove-net. Most of the specimens were large, and all these had well-developed reproductive organs, yet eggs were only running from a few. The *spawn* (with rough, warty capsules) was also found on the *Fucus* and stones to which the *Fucus* was fixed, yet not so abundantly as on the 7th at Fænø Kalv.

All the cottids taken near Fænø in the beginning of May were measured. The measurements are given on the lists p. 58 and p. 59. The following remarks accompany the measurements in the journal:

In the small specimens of the common and long-spined Cottus ($1^1/_4$—$3^1/_2$ inches) the reproductive organs were very little developed. All the larger specimens of the common Cottus had spawned, but none of the long-spined Cottus. Some of these had ripe, running spawn, most had well-developed, but not quite ripe sexual products.

The investigation made of the cottids at Fænø shows, that *the spawning time for the common Cottus is over before the beginning of May, whilst the long-spined Cottus is yet scarcely in full spawn.*

On May 12th 1902, the Director writes in the journal that he had not observed any spawned specimens of the long-spined Cottus at Fænø up to that date. The Biological Station left the Little Belt shortly afterwards, and the condition of the cottids there was lost to sight. In the beginning of June (10th) a spawned female of the long-spined species was found in Ise Fjord (Kattegat coast of Sealland).

D. 23—11—02. Off Kløverhage, 11 fm. (Great Belt). Small English trawl: 3 common Cottus, one female and two males. The female was full of large-grained, light-red *spawn,* about to be laid, the males had running *milt.*

D. 5. & 8—12—02. *Spawn* of *common Cottus* laid in tank, sent from Nyborg (Great Belt) to Copenhagen.

D. 4—1—03. Lyø in E., 20 fm. (western Baltic). Young-fish trawl on bottom: 1 *female of common Cottus, spawned.*

D. 5—1—03. Lyø in E., 13—11 fm. Young-fish trawl on bottom: *spawn of common Cottus* on roots of *Laminaria saccharina* and on *Flustra.*

These observations from November 1902 to January 1903 show, that the spawning time of the common Cottus falls in December. Ehrenbaum (l. c.) states, that the common Cottus at Helgoland spawns in December and January. We also have a single observation which indicates, that the spawning time may extend into January:

D. 14—1—04. Hestehoved in W. N. W., 4 miles, 11 fm. (true Baltic). Small English trawl: 3 *common Cottus,* a female and two males; the female with *well-developed spawn.*

At the end of February and beginning of March 1903 we examined a number of specimens of the common Cottus in the Great Belt and true Baltic. They had all spawned. We also had an opportunity on this occasion to observe that some of the eggs which remained in the ovary of the spawned females contained distinct embryos.

D. 27—2—03. Hestehoved in N. W. to W., 4 miles, 11—12 fm. (true Baltic). Small English trawl: 4 *common Cottus,* three male and one male. Ovaries of females almost empty, some of the *eggs remaining* contained distinct embryos.

The same condition was noted by Nordqvist (Meddel. Societ. p. Fauna et Flora fennic)* in females of the common Cottus on the Finnish coast. This can only be explained on the supposition that *pairing* takes place. Ehrenbaum says (l. cit. p. 123): Aber auch das Vorkommen der inneren Befruchtung als Abnormität muss vorläufig als auf die nördlichste Ostsee beschränkt angesehen werden.« The preliminary boundary marked off by Ehrenbaum can now be extended, as we have found, *that fertilisation in the common Cottus also occurs at the Danish coasts of the true Baltic.*

In earlier years the spawn of the two species of Cottus was occasionally

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* 26 Bd. 1900.

found. There are three bottles in the collection, one of which contains the spawn of the common Cottus and is labelled:

D. 5—1—95. Marens Rev at Frederikshavn (northern Kattegat), *spawn*, collected by L. Kolderup Rosenvinge.

The other three bottles contain the spawn of the long-spined Cottus; they are labelled:

D. 15—5—90. Holbæk Fjord (north coast of Sealland). *Spawn* laid on a set-net.

D. 22—5—90. Holbæk Fjord. *Spawn* from a set-net (probably a portion of the one found on the 15th) with wholly or almost wholly escaped young.

Middle of April —91. Føns Skov (Little Belt). *Spawn* found on beach.

As a result of these observations we may say concerning the spawning period of the two species of Cottus in the Danish waters, that *the common Cottus spawns in December—January and the long-spined Cottus in April—May.*

In consequence of the difference in the spawning time of the two species, the *pelagic young* also appear at different periods of the year.

The *pelagic young* of the common Cottus occur already in January.

In 1892 the Director found pelagic Cottus young in Fænø Sound in January—May. There can be doubt that the young taken in *January* at any rate belonged exclusively to the common Cottus.

In 1902 a number of the young of the common Cottus were sent from Nyborg (Great Belt) to Copenhagen in January. They were taken in the well of "Stationen" and were small, all with yolk-sac attached. When "Stationen" was moved to Fænø and lay there from March 5th to May 22nd, the occurrence in quantities of the young of the common Cottus could be followed from day to day. These young were most abundant in *March*; on March 23rd 169 young of the common Cottus were taken in one of the "bobinet" nets; the net had been hanging in the current for $1^1/_2$ hours. Even in the beginning of *April* the young of the common Cottus were present in most of the catches of pelagic young. At the end of April they became scarcer and were quite absent in May, in which month only one pelagic young of the common Cottus was taken in Fænø Sound, namely on May 7th.

In 1903 we took the pelagic young of the common Cottus in the months *February—May* (see Tab. 3 A), but in May not later than the 1st, when we took two in the young-fish trawl in the western Baltic at Ærø.

During *the February cruise of the »Poseidon«* in 1903 Ehrenbaum and Strodtmann found the pelagic young of the common Cottus in the western and the true Baltic. They found none in these waters in May.

When A. C. Johansen began his spring cruise in 1904 (see Tab. 1, North Sea, Skager Rak and Kattegat, February—March), the pelagic young of the common Cottus were common, but they were not evenly distributed over these regions. Johansen found many in the Kattegat on *February* 16th but none in the Skager Rak on the 17th. The result of some hauls in the North Sea with the young-fish trawl on February 26th was a single pelagic specimen ot the common Cottus. On the return cruise from the North Sea in *March* Johansen again found no pelagic young of the common Cottus in the Skager Rak, but many in the Kattegat. During our March cruise with the »Sallingsund« in the Great Belt, western and true Baltic (see Tab. 1) we found everywhere many pelagic young of the common Cottus.

In February—March 1905 many pelagic young of the common Cottus were present in all the Danish waters within the Skaw, but none in the Skager Rak.

In *April* 1904 the pelagic young of the common Cottus were not so abundant as earlier in the year (see Tab. 3 B). None were again taken in the Skager Rak in this month (see Tab. 1, Skager Rak, April 28th). Even in *May* (6th) we found some in the western Baltic at Ærø (see Tab. 1), and on *June* 7th we took one, still small, pelagic young of the common Cottus in the Sound, N. of Hveen (see Tab. 1); but just as in 1902, when the occurrence of the pelagic young of the common Cottus in Fænø Sound was followed from day to day in the months of March—May, only a single straggler was taken in May, so that the occurrence of the pelagic young of the common Cottus in May and June 1904 must be regarded as exceptions from the rule. It thus appears: that *the young of the common Cottus occur in Danish waters in January—April with a few stragglers in May and June. We have found them in all our Danish waters with exception of the Skager Rak.*

The largest pelagic specimens of the common Cottus we have taken had a length of ca. 15 mm. Concerning those a little larger Ehrenbaum says (l. cit. p. 137): "Dagegen wurden die nächst älteren Formen von 17 bis 31 mm. Länge, welche auch noch planktonisch leben, in April erst in einiger Entfernung von der Küste (40 Seemeilen) gefangen." We know nothing of a pelagic occurrence of such large specimens of the common Cottus in Danish waters.

The occurrence of the *pelagic young of the long-spined Cottus* was not regularly investigated before 1904. In that year we found its pelagic young in May and June (see Tab. 1), yet only at the end of May, as we took the first specimens in the Great Belt on May 24th. This agrees well with the result of investigations at Fænø in 1902, that the spawning time is in April—May. Pelagic young of the long-spined Cottus were taken in 1904 in the Kattegat, Sound, Great and Little Belt, but not in the western and eastern Baltic, though we investigated both these regions in June (see Tab. 1).

In 1902 some pelagic specimens of the long-spined Cottus were taken in the northern Kattegat and Skager Rak in *June*, and a single specimen in the southern Kattegat in June 1903 (in the pelagic net, therefore not included in Tab. 3 A).

The pelagic young of the long-spined Cottus thus occur in Danish waters in the months of May and June. We have found them both in the waters within the Skaw, except the western and true Baltic, and also in the Skager Rak.

There is a great difference in the abundance of the pelagic young of the two Cottids occurring in Danish waters; whereas *the pelagic specimens of the common Cottus* belong in early spring to the *commonest* pelagic fish young, the *pelagic specimens of the long-spined Cottus* are always scattered and few in numbers in our catches.

The **bottom-stages** of the common Cottus have rarely been found during the investigations of the Biological Station. In 1902 one specimen was taken in the northern Kattegat and three in the western Baltic:

D. 13—6—02. W. from Nordre Rønner, 5 fm. (Kattegat). Young-fish trawl on bottom: 1 *common Cottus*, 1 inch (c. $2^1/_2$ cm.).

D. 18—7—02. N. from Bagenkop, 8 fm. (western Baltic). Young-fish trawl on bottom: 1 *common Cottus*, 3 cm.

D. 18—7—02. N. from Bagenkop, 8 fm. 5—4 fm. Young-fish trawl on bottom: 2 *common Cottus*, $2^1/_2$ and $3^1/_2$ cm.

Tab. H. Common Cottus, *Cottus scorpius*.

Centimeters	inches (Da.)	At Fænø in the beginning of May 1902.			
		females.		males.	
c. 26	10	o o			
		o o			
c. 23.5	9	o o o o			
		o o o o			
		o o o o			
		o o o o o o o		o	
c. 21	8	o o o o o o o o		o o o	
		o o o o o o			
		o o o o o o o		o o o o o o o	
		o o o o o o o o o	II Gr.	o o o o o o o o o o o o o o o	
c. 18	7	o o o o o o o o		o o o o o o o o o o o o o o o o o o o	
		o o o o o o o o o o		o o o o o o o o o o o o o o o o o o o o o o o o o o o	II Gr.
		o o o o o o		o o o o o o o o o o o o o o o o o o o o o	
		o o o		o o o o o o o o o o o o o o o o o o o o o o	
c. 15.5	6	o o o o		o o o o o o o o o o o o o o o o	
				o o o o o o o	
				o o o o o	
		o o o		o	
c. 13	5	o o o			
		o o o o o o o			
		o o o o o o			
		o o o o o o o o o	I Gr.	o	
c. 10.5	4	o o o o o o		o o o o	I Gr.
		o o o o o o o		o o o o o	
		o o o o		o o o o	
		o o			
c. 8	3	o o			
c. 5	2				
c. 2.5	1				
		o (pelagic)	0 Gr.		0 Gr.

In 1901, Th. Mortensen, then assistant at the Biological Station, noted the following catches in the journal:

D. 29—6—01. Off Snogebæk (Bornholm), 5 fm. (true Baltic). Sand-eel net: 1 *common Cottus*, $^3/_4$ inches (ca. 2 cm.).

D. 6—7—01. Two-Brushes on Salthammer Reef (Bornholm) in N. W. $^3/_4$ W., $1^1/_2$ miles, 15 fm., stones, algæ. Dredge: 1 *common Cottus*, $^1/_2$ inch (c. 13 mm.).

In the collections there is a bottle with a number of young specimens of the common Cottus ca. 5 cm. long. It is labelled:

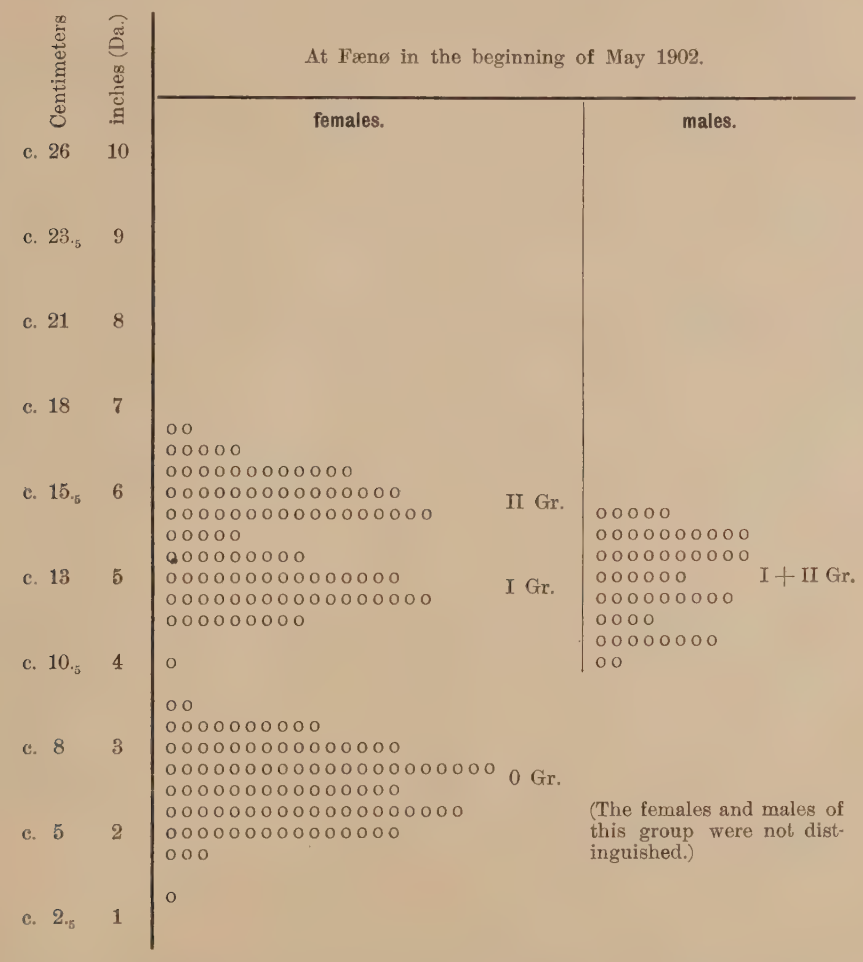
D. 2. to 4—8—99. Esbjærg Deep, $^1/_2$—$1^1/_2$ fm. (North Sea).

Apart from these catches we have not found the bottom-stages of the common Cottus in the Danish waters during recent years.

The *bottom-stages of the long-spined Cottus* have also rarely been met with. In the western Baltic one specimen was taken in January 1903:

D. 5—1—03. S. from Lyø, $2^1/_2$—4 *Fucus vesciculosus* and *serratus*. Toothed Dredge: 1 *long-spined Cottus*, scarcely 2 inches (ca 5 cm.).

Tab J. Long-spined Cottus, *Cottus bubalis*.



In the collections is a specimen of *the long-spined Cottus* of 4 cm. labelled Flækøjet, 1—9—91 (Flækøjet is a ground in the Little Belt near Fænø).

In May 1902 we found a number of the bottom-stages of the long-spined Cottus at Fænø, but by this time they were about a year old.

All the pelagic young of the long-spined Cottus we have found had a length of ca. 6—9 mm.

A good picture of the *growth* of the two species of Cottus will be obtained from the lists of measurements of the Cottids at Fænø in May 1902. A 0 *group*

of the common Cottus will be seen in these lists, yet only a part of the 0 group which is still pelagic in the beginning of May, as the bottom-stages, which must already be present in this month, were not taken by these investigations. The I *group of the common Cottus* is from 3 to $5^1/_4$ inches (ca. 8—13.5 cm.). The males are a little smaller than the females. This difference in size becomes even more distinct in the II *group*, which includes females from 6 to $9^3/_4$ inches (ca. 15.5—25.5 cm.) and males from $5^1/_4$ to $8^1/_4$ inches (ca. 14—21.5 cm.). None of the I group have yet spawned, whereas the II group is composed of spawned specimens. *The common Cottus thus attains maturity at the end of its second year.*

There are likerwise *three groups of the long-spined Cottus* in the lists. The smallest specimens, of $1^1/_4$ to $3^1/_2$ inches (ca. 3.5—9 cm.) are about a year old and, as the pelagic young do not occur in the beginning of May, must be ascribed to the 0 *group*. Above this group, the list for the females shows two groups almost fused together. The I group is about to conclude its regular growth and join on to the older years in a common group, which on the appearance of the new 0 group (i. e. the pelagic young) would be called the II group. The list for the males of the long-spined Cottus is rather irregular, but the condition is certainly the same as for the females, viz. that the I grup is about to fuse with the II group. The males are smaller than the females. All the specimens of the I and II group are taking part in the spawning. *The long-spined Cottus, like the common Cottus, in thus mature at the end of its second year.*

It appears from the lists of measurements, that the growth of the common Cottus at Fænø is more rapid than that of the long-spined species; but the growth in other parts of the Danish waters is perhaps not the same as that observed at Fænø.

Resumé. *The common Cottus* spawns in December—January. *The pelagic young* are very abundant in the inner Danish waters in January—April (May, June). *The bottom-stages* have been seldom found. *Maturity* begins at the end of the second year, when the ordinary *growth* ceases.

The long-spined Cottus spawns in April—May. *The pelagic young* appear in May—June; they are much more rare than the pelagic young of the common Cottus. *The bottom stages* have seldom been found. *Maturity* begins at the end of the second year, when the ordinary *growth* ceases.

Pogge, *Agonus cataphractus.*

Just as for the two Cottus species we have also good information regarding the *spawning time* of the pogge from the *spring* of 1902, when investigations were carried on in the Little Belt by the Biological Station.

D. 10—3—02. Off Fredericia. English trawl: 1 *Agonus* with large, light red, almost ripe *spawn.*

D. 22—3—02. Fænø Sound. One *Agonus* with *spawn* taken in cod traps.

D. 7—4—02. An Agonus has laid some *clumps of spawn* in "Stationens" tank, where it has been for a few weeks.

The eggs laid in the tank on April 7th have been described by Johs.

Schmidt in the journal. The description differs in no essentials from that given by Ehrenbaum (l. c.) of the Agonus eggs at Heligoland.

From these observations it will be seen, that the pogge spawns in April in the Little Belt. Ehrenbaum (l. c.) gives the months January—April as the spawning time at Heligoland. Whether the pogge also begins spawning before April in the Danish waters has not been closely investigated.

Eggs of the *pogge* were found in the Little Belt in April 1902:

D. 10—4—02. Dredged for fish spawn at Fænø Kalv with the toothed dredge. *Spawn of pogge* was taken, fixed between the roots of *Laminaria digitata,* as also a clump which lay loose amongst the bottom-material.

D. 24—4—02. At Fænø Kalv. Some dredgings made on Alga- and Bryozoa-ground. Spawn of the pogge amongst the roots of *Laminaria digitata* was taken.

The hatching of the eggs proceeds very slowly, as will be seen from the following journal extracts:

D. 16—10—02. Nyborg (Great Belt). Well developed embryos with distinctly pigmented eyes now appear in the eggs laid by a pogge in the tank on April 7th. The eggs lay in the tank through the summer.

Ehrenbaum (l. c.) considers the incubation-period at Heligoland to last about a year, and it must have a similar duration with us, as appears from the time at which the *pelagic young* occur.

In 1891—92 the Director observed the pelagic Agonus young in Fænø Sound in the months of January and March—May.

In 1903 the pelagic Agonus young were taken in Fænø Sound in the months of March, April and May, but only in small numbers in May and not later than the 13th. The catches from March 1st—15th have been preserved in the collections in a single bottle. Some very small specimens are amongst them, as their size, measured on the preserved specimens, varies from ca. 9—13 mm. The preserved pelagic specimens of later date, 1902, have a size of ca. 13—16 mm. It is probable therefore, that all the pogge eggs shed near Fænø in the spring of 1901 have been hatched before the middle or possibly before the beginning of March 1902.

In 1903 we found the pelagic Agonus young in February—May, but in May only during the first half of the month.

Ehrenbaum and Strodtmann took them in February 1903, both in the western and true Baltic, but only in small number. They found none in May.

In 1904 (see Tab. 1) we found the pelagic Agonus young from January to June, yet not many after March. In June we found them only in the beginning of the month, for example, on June 4th we took one specimen at Anholt (see Tab. 1, Kattegat), and on June 7th one specimen N. of Hveen (see Tab. 1, Sound). The last-mentioned was still small and was taken along with a small specimen of the common Cottus (see under common Cottus).

In 1904 we took the pelagic Agonus young in all the Danish waters from the true Baltic to the North Sea. None were taken on the February and March spring cruise of the »Thor« in the Skager Rak, though the young-fish trawl was used a good deal (see Tab. 1) and though not a few pelagic Agonus young were taken in the Kattegat by the »Thor« and in the southern waters by the »Sallingsund«

during these months. On the other hand we got some at the end of April when we were in the Skager Rak (see Tab. 1).

The pelagic young of the pogge are thus found in the Danish waters in the months January—May and a few stragglers in June. They are taken in all the Danish waters, but not in the Skager Rak in the first months of the year.

The *bottom-stages* of the pogge have only been observed a few times.

D. 30—6—98. At Frederikshavn, 6 fm. (northern Kattegat). One *Agonus*, 22 mm. was taken.

D. 4—8—99. Esbjerg Deep, $^1/_2$—$1^1/_2$ fm. (North Sea), 1 *Agonus*, 43 mm. (measured in the preserved condition) was taken with some small specimens of the common Cottus.

Specimens of 6—8 cm. have often been taken in the Danish waters in the spring and summer, they belong probably to the I group.

Crested Blenny, *Carelophus ascanii.*

The pelagic young of Carelophus were first noted in the Danish waters in the spring of 1902. They were taken in Fænø Sound in the period from the 23rd to 25th of *March* to the number of 16 specimens in all.

In 1903 A. C. Johansen took a pelagic young of Carelophus in the Kattegat on March 12th. Ehrenbaum and Strodtmann found two in the western Baltic on the 16th and 17th of *February* 1903, the one however on the boundary to the true Baltic (German station V).

In 1904 A. C. Johansen took 4 specimens in the Skager Rak on March 7th and 7 in the Kattegat between *February* 16th and March 23rd.

Pelagic young of Carelophus have thus in small number been noted from the western Baltic, Little Belt, Kattegat and Skager Rak in the months of February and March.

Neither the bottom-stages nor older stages of Carelophus have anywhere been found in Danish waters.

Lumpenus lampetriformis.

Investigation of the *spawning-period* of Lumpenus was begun in 1902.

D. 15—5—02. W. S. W. from Lyø*, 19—20 fm. (western Baltic). Young-fish trawl on bottom, 10 minutes: over 1000 *Lumpenus* of 0 group and many older specimens of the same species.

The specimens taken were measured. The resulting Table of measurements is given on page 65. It was inscribed in the journal by Johs. Schmidt, who has also added the note that all the specimens were unripe.

In the middle of May therefore, there was nothing to indicate proximity to the spawning period. Further investigations were therefore postponed to the autumn:

D. 24—11—02. W. S. W. from Lyø, 19—20 fm., soft bottom. Young-fish trawl on bottom: 100 *Lumpenus*, the larger of which, 6—7 inches long (c. $15._5$—18 cm.) had yellowish white, yet unripe *spawn.*

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* exact bearings: south end of Bjørnø to south end of Lyø, Horne Church well clear of the north end of Lyø.

The spawning period must therefore have been close at hand and in the beginning of January investigation of the Lumpenus at Lyø was again undertaken:

D. 4—1—03. W. S. W. from Lyø, 20 fm. Young-fish trawl on bottom: a large number of *Lumpenus*, which were measured.

The list of the measurements is given on p. —. It will be seen that the spawning time was already over in the western Baltic by January 7th, as:

all the females recognised were spent with contracted ovaries and old eggs.

Some days later a large number of Lumpenus were taken at another place in the western Baltic, one of which was ripe.

D. 6—1—03. W. of Skjoldnæs, 18—21 fm. Young fish trawl on bottom: a large number of *Lumpenus**. Only one of the females examined had *ripe, running spawn*; this was clear as glass, slightly pale yellow with colourless oil globules. The other females were spent.

In addition to these brief notes on the appearance of the eggs, Johs. Schmidt also inscribed in the journal a list of the measurements made of the Lumpenus taken at this station. This list is not given here, as the groups it shows quite correspond to those shown by the measurements from Lyø on the 4th.

From the 1903 investigations we may conclude, that *the Lumpenus spawn in December in the western Baltic*.

Of the spawning in other regions we have only a single observation:

D. 14—1—04. Hestehoved in W. N. W., 4 miles, 11 fm. Small English trawl; 3 *Lumpenus*, one female and two males, the female with well developed *spawn*.

The *pelagic young* of Lumpenus were not determined before the spring of 1902. In that year a great number were taken in Fænø Sound in *March* and *April*. None were taken at the end of April or in May. Pelagic Lumpenus young were taken on an excursion in March to the true Baltic.

D. 19—3—02. S. E. of Møen lightship, ca. 16 fm. Young-fish trawl on bottom, 2 hauls, each of 10 minutes: many pelagic young of *Lumpenus*, a few fish of other species. — Pelagic net on pole, 10 minutes: a few *Lumpenus young*, as also other fish young.

In 1903 we took the pelagic Lumpenus young in *February—May*. The large number of pelagic Lumpenus young taken in May in the western Baltic will be evident from a glance at the summary for 1903 (Tab. 3 A). An examination of the separate journal extracts (Tab. 1), which form the basis of the summary, will show that most of the Lumpenus young taken in May come from bottom-hauls, so that we cannot determine whether they have lived on or near the bottom.

Ehrenbaum and Strodtmann state that they found the pelagic Lumpenus young in great numbers in *February* 1903 in the western Baltic and a single specimen on May 19th in Kadet Channel (Station V, in the western Baltic near

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*) Johs. Schmidt endeavoured to utilize this rich catch of Lumpenus by cutting the fish in two and fixing the pieces as bait on cod hooks.

D. 7—1—03. 2.30 p. m. S. E. of Sprogø, 16—25 fm.: set 200 hooks, baited with pieces of Lumpenus.

Same date, N. E. of Sprogø, 3—5 fm.: set 400 hooks, baited in the same way.

D. 8—1—03. The hooks in deep water (16—25 fm.) taken up in the forenoon. They gave 29 cod, most of which were 13—16½ inches (ca. 34—43 cm.), and 18 dabs. Very little bait was left on the hooks.

Same day, afternoon. The hooks in shallow water (3—5 fm.) taken up. They gave 22 cod and 3 dabs. A good deal of bait remained on the hooks.

the boundary to the true Baltic). They thus found none in the true Baltic either in February or May.

In 1904 we took the pelagic Lumpenus young from March to May. They were exceedingly abundant in *March* in the southern waters. Most were taken in the western Baltic but many also in the true Baltic and Great Belt. In March we took 9 specimens in the Kattegat, all in the northern part at Læsø Rende.

In *April* (13th) we took one specimen in an intermediate haul (see Tab. 1) and in *May* a large number in the western Baltic, some even as late on May 30th.

It was only in the western Baltic that we found the Lumpenus young in May, and just as in May 1903 the greatest quantity was taken in bottom-hauls with the young-fish trawl. In 1904 this apparatus however was provided with blocks, so that it worked somewhat above the bottom. It was therefore possible to distinguish between the young, which lived on the bottom and those which lived intermediately near the bottom. The bottom-hauls with the young-fish trawl (without blocks) are seldom noted in Tab. 1 and not for the May stations in the western Baltic. Thus all the Lumpenus young noted in Tab. 1, western Baltic, for May were really pelagic, but the great majority were living near the bottom. It thus appears that the pelagic young of Lumpenus in the transition to the bottom-stage approach the bottom and live pelagically there for some time. Some journal extracts from the investigations in the western Baltic in March—June will best illustrate this condition:

D. 23—3—04. Skjoldnæs in N. E., 19 fm. Young-fish trawl on surface, 10 minutes: 1 *Lumpenus young* and 163 young of other species. Young-fish trawl — 10 fm., 10 minutes: 82 *Lumpenus young*, 72 young of other species. Young-fish trawl on blocks on bottom, 10 minutes: 3 *Lumpenus young* and 4 young of other species. Young-fish trawl on bottom, 10 minutes: no young, 5 *older Lumpenus*.

Most if not all the Lumpenus young were on that day living at the highest 10 fathoms below the surface.

D. 6—5—04. W. from Skjoldnæs, 18 fm. Young-fish trawl — ca. fm., 10 minutes: no young of Lumpenus, 41 young of other species. Young-fish trawl — ca. 16 fm., 20 minutes: 10 *Lumpenus* young, 38 young of other species. Young-fish trawl on blocks on bottom, 10 minutes: ca. 20 Lumpenus young, ca. 26 young of other species. Young-fish trawl on bottom, 10 minutes: ca. 30 *Lumpenus* of all stages, also of 0 group, no other fish young, a few other fish.

Most of the Lumpenus young taken on this day were 18 mm. long. All the others were larger and gave the impression of being near the end of their pelagic life.

We see from this that the Lumpenus young were nearing the bottom in the beginning of May. Even at the end of May they had not all gone over to the bottom-stage:

D. 30—5—04. W. of Skjoldnæs, 18 fm. Young-fish trawl — ca 15 fm., 30 minutes: 1 *Lumpenus young*, ca. 35 mm., 94 young of other species. Young-fish trawl on blocks on bottom, 20 minutes: 7 *Lumpenus young* 30—40 mm., 65 young of other species.

Though we thus still found a few Lumpenus young in intermediate waters on May 30th, the great mass of the Lumpenus young in the western Baltic must by that time have changed over to the bottom-stage. On June 13th, when we were again fishing at Ærø, the pelagic life had been given up:

D. 13—6—04. W. of Skjoldnæs, 18 fm. Young-fish trawl — ca. 16 fm., several hauls: no young of Lumpenus, many young of other species. Young-fish trawl on bottom, 10 minutes: 6 Lumpenus of 0 group with brown abdominal pigment.

We may thus conclude, that *the transition to the bottom-stage in the western Baltic takes place in May:*

Tab. K. Lumpenus, *Lumpenus lampetriformis.*

Centimeters	inches (Da.)	W. S. W. of Lyø, 19—20 fm. (western Baltic). 15—5—02. *Young-fish trawl on bottom,* 10 minutes. ♀ = definitely females, O = males or doubtfully females: all unripe. Some of the specimens of the 0 group (well over 1000) were measured in order to indicate the place of the group in the list.		W. S. W. of Lyø, 20 fm., 4—1—03. *Young-fish trawl on bottom.* ♀ = definitely females, O = males or doubtfully females. All the definite females had spawned, with contracted ovaries and old eggs.	
c. 28.5	11	O O			
c. 26	10	♀♀ O ♀♀ O O			
c. 23.5	9	O O ♀♀♀O O O		♀ ♀	
		♀♀♀♀O		♀♀	
		♀♀♀♀♀♀♀♀O O O O O O O O O O		♀O	
c. 21	8	♀♀♀♀♀♀♀♀♀♀O O O O O O O O O O		O O	
		♀♀♀♀♀♀♀♀♀♀O O O O O	II Gr.	♀♀	II Gr.
		♀♀♀♀♀♀♀♀♀♀♀♀♀♀♀♀♀O O O O O O O O O O		♀	
		♀♀♀♀♀♀♀♀♀O O O O		♀♀O	
c. 18	7	♀♀♀♀♀♀♀♀♀♀♀♀♀♀O O O O O O O		♀	
		♀♀♀♀♀♀♀♀♀♀♀♀♀O O O O O O		♀	
		♀♀♀♀♀♀♀♀♀♀♀♀O O O O O		♀	
		♀♀♀♀♀♀♀♀♀O O O O O O			
c. 15.5	6	♀♀♀♀♀♀♀♀♀O O O O O O O O O O		O O O O O	
		♀♀♀O O O		O O O O O	
		♀♀♀O O O		O O O O O O O O O	
		♀♀O O O O		O O O O O O O O O O O O O	
c. 13	5	O O O O O O O		O O O O O O O O O O O O O O O O O O O	
		O O O O O O O O O O O O O O O O O O O		O O O O O O O O O O O O O O O O O O O O O O O O	I Gr.
		O O O O O O O O O O O O O O O O O O O O O O O O		O O O O O O O O O O O O O O O O	
		O O O O O O O O O O O O O O O O O O O O O O		O O O O O O O O O	
c. 10.5	4	O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O	I Gr.	O O	
		O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O			
		O O O O O O O O O O O O O O O O O O O O O O			
		O O O O O O O O O O		O O O	
c. 8	3	O O		O O O O O	0 Gr.
				O O O O O	
				O O O	
c. 5	2	O - - - -			
		O O O O O O O O O O O O O - - - - - -			
		O O O O O O O O O O O O O O O O O O - - - - -			
		O O O O O O O O O O O O O O O O O O O O - -	0 Gr. (only a few of this group measured)		
c. 2.5	1	O O O O O O O O O O O O O O O O O O O O - - -			
		O O O O O O O O O O O O O O O O O - - - - - -			
		O O O O O O O O O O O O O O O O O O O - - - -			
	0				

We have had no difficulty in finding the **bottom stages** of the Lumpenus. They live together with the older annual groups on the soft, covered ground in the western and true Baltic. Here they pass their whole life after the pelagic stage is ended. We can therefore obtain all the different groups in the same haul

with a sufficiently close-meshed apparatus, e. g. young-fish trawl. Each of the lists on p. 65 is based on the catch of a single haul with the young-fish trawl.

We found the bottom-stages in very great numbers in the western Baltic, as will be seen from the accompanying journal extracts. A considerable number of the bottom-stage was also taken in the true Baltic.

D. 3—7—02. Hestehoved in W. N. W., 12 fm. Young-fish trawl on bottom, 10 minutes: Ca. 800 *bottom-tages of Lumpenus*, 83 older specimens of same species and a number of other fishes.

This station lies to the south of Møen. We have often taken the Lumpenus further to the east in the true Baltic, both the bottom-stages and the older specimens, and in considerable numbers. At Bornholm in 1901 a young specimen in the bottom-stage was taken along with a number of older specimens of the same species.

D. 28—6—01. Off Aarsdale (Bornholm), ca. 38 fm. Toothed dredge: 1 *Lumpenus*, $1^1/_4$ inches (32 mm.).

Tab. L. Lumpenus, *Lumpenus lampetriformis*.

Centimeters	inches (Da.)	Arkona in S. S. W, 10 miles, 23 fm. (true Baltic), 23—7—03. Small English trawl (with small-meshed net round cod-end).	
	11		
28		o	
27			
26	10	o o	
25		o o	
24		o o	
23	9		
22			
21	8	o o o	
20		o o o	
19		o o o o o	
18	7	o o o o o o o o o o o	II Gr.
17		o o o o o	
16		o o	
15	6	o o	
14		o o o o	
13	5	o o o o o o o o o o o	
12		o o o o o o o o o o o o o o o o o o o o o o o o o	I Gr.
11	4	o o o o o o o o o o o o o o o o o o o o o o o o o	
10		o o o o o o o	
9		o o o o	
8	3		
7			
6		o o o o o o o o o o o	
5	2	o o o o o o o o o o o o o o o o o o o o o o o o	0 Gr.
4			
3			
2	1		
1			
0	0		

It appears from the above, that the pelagic young of Lumpenus are common, not only in the two parts of Baltic but also in the Great and Little Belt, but rare in the Kattegat. We have not taken the bottom stages in the Belts, the right sort of soft ground in deep water being scarcely to be found there, whereas we have several times taken single specimens of the bottom-stage at suitable localities in the Kattegat:

D. 7—5—03. Anholt lighthouse in N. to W., ca. 6 miles, 22 fm. (southern Kattegat). Young-fish trawl on bottom: 1 *Lumpenus*, ca. 4 fm.

D. 12—7—04. Anholt lighthouse in N. W. to W., $5^1/_2$ miles, 21 fm. Young-fish trawl on bottom: 2 *Lumpenus*, one of which was ca. 6 cm.

The young of Lumpenus thus require soft ground in deep water, about 20 fm., to be able to change over to the bottom-stage. The older stages are also found together with the bottom-stages, and we may form the following rule, based on our many catches of Lumpenus: Lumpenus are to be found everywhere where there is soft bottom at a depth of ca. 20 fm., many in the southern Danish waters, few in the Kattegat. Where there is soft ground at a less depth, a few are to be found in the southern waters, none in the Kattegat.

The **growth** of Lumpenus is specially easy to determine, both the young and old specimens, as mentioned before, being taken in the same haul. From the measurements it will be seen, that the Lumpenus in the western Baltic *have a length of at least $6^1/_2$ inches (ca. 17 cm.) at the end of their third year. It becomes mature then and the ordinary growth ceases. Tab. L shows, that the growth in the true Baltic is almost as in the western.*

Gunnel, *Centronotus gunellus.*

No observations have been made by the Biological Station regarding the spawning of this species.

The **pelagic young** were observed in Fænø Sound in *February—May* 1891—92, and they were taken in the collections of 1890—1901 in *January—April* in the Great Belt, Kattegat and Skager Rak, in January only in the Great Belt and southern Kattegat, in April only in the Skager Rak.

In 1892 the pelagic young of the gunnel were found in *March* and beginning of *April* in Fænø Sound. On May 2nd a specimen was taken in a bottom-haul with the young-fish trawl.

In 1903 the pelagic gunnel young were taken in *February* and *March*. We found them in the true Baltic, Great Belt and Kattegat. The catches in the true Baltic are not put down on Tab. 3 A, as they were made with the pelagic net. I mention them here therefore:

D. 27—2—03. Hestehoved in W. $^1/_2$ N., 12 fm. Pelagic net on pole, 15 minutes: ca. 100 fish young, amongst which 1 *young of gunnel.*

D. 27—3—03. Gedser lighthouse in W. to S. $^3/_4$ S., $7^1/_2$ miles, 10 fm. Pelagic net on pole: 11 fish young, amongst which 1 *young of gunnel.*

Ehrenbaum and *Strodtmann* found a small number of pelagic gunnel young in the western and true Baltic in 1903, namely, 4 in *February* in the western Baltic and 1 "noch jugendlich" in November in the true Baltic between Trelleborg and Sassnitz.

In 1904 (Tab. 1) we took the pelagic young of the gunnel from *February to June,* but in June only in the beginning of the month, taking one in Aalbæk Bay on June 1st and two at Anholt on June 4th (see Tab. 1, Kattegat).

The distribution of the pelagic young of the gunnel is fairly northern, especially in comparison with the pelagic young of Lumpenus. This appears clearly from Tab. 3 B. In the Kattegat, where we only found them in March along with a few pelagic young of Lumpenus, we found the pelagic young of the gunnel in

the months of February—June. In 1904 the pelagic young of Lumpenus were taken in greatest number in the western Baltic, then follow the Great Belt and the true Baltic, whereas we took the greatest number of the pelagic young of the gunnel in the Lim Fjord, Kattegat and Great Belt. In April we found only a few pelagic fish young in the Lim Fjord, but over half of these were gunnel. The water in the fjord is fairly salt, usually ca. 3 %.

From these investigations it appears, that the *pelagic young of the gunnel are found in the Danish waters from January (in the true Baltic from November, according to Ehrenbaum and Strodtmann) to the beginning of June. They are found in all the Danish waters from the true Baltic to the Skager Rak, only in small numbers in the western and true Baltic and Skager Rak, in specially great numbers in the Lim Fjord.*

The **bottom-stages** of the gunnel have only once been found.

D. 18—7—02. S. of Gulstav, 6--7 fm. (western Baltic), red algæ. Young-fish trawl on bottom: 3 *gunnel*, of which one of the 0 group.

This specimen is preserved in the collection and measures $3^1/_2$ cm. in the preserved condition.

Older specimens of the gunnel have been found in all the Danish waters except the true Baltic. We have seldom taken more than one in a haul.

Catfish, *Anarrhichas lupus.*

Concerning the **spawning** of this species only the following is noted in the Biological Station's journal:

D. 6—7—98. Skaw ligthship in S. W., 40 fm. (Skager Rak). Danish trawl: 1 *catfish*, spawn far from ripe; eggs had a diameter of 3 mm.

D. 17—4—02. S. of Anholt, 10 miles, 16 fm. (Kattegat). English trawl: 1 large *catfish*, partly spawned.

The **young** of the catfish, like the young of Carelophus, was first detected in Danish waters in the spring of 1902, when the the Biological Station lay in Fænø Sound. A *young catfish* was taken there on April 6th. Since then only two catfish young have been found in Danish waters, both in the northern Kattegat, where A. C. Johansen took them in 1904, on March 14th and 22nd, in a haul with the young-fish trawl (see Tab. 1). The apparatus was on the bottom both times, and there is thus the possibility, that the catfish young taken were not living pelagically.

The young of the catfish have thus been found in Danish waters at the end of March and beginning of April, three specimens in all, one in the Little Belt, and two in the northern Kattegat.

Otherwise only large specimens of the catfish have been taken in the Danish waters, and never more southerly than the Kattegat.

Common names of the species.

Name of the fishes whose young we have found in the Danish waters within the Skaw.

dem. denotes, that the species has demersal eggs, pel., that it has pelagic eggs.

English name:		Latin name:
Common sea scorpion	dem.	*Cottus scorpius,* Linné
Longspined sea-scorpion	dem.	» *bubalis,* Euphrasén
Gurnards	pel.	*Trigla sp.**
Pogge	dem.	*Agonus cataphractus,* Linné
Mackerel	pel.	*Scomber scombrus,* Linné
Horse-mackerel	?	*Caranx trachurus* (Linné)
Threespined Stickleback	dem.	*Gasterosteus aculeatus,* Linné
Nine-spined »	dem.	» *pungitius,* Linné
Fiften-spined »	dem.	*Spinachia vulgaris,* Fleming
Labroids	pel.	*Labrus sp.**)
Crested blenny	dem.	*Carelophus ascanii* (Walbaum)
Lumpenus	dem.	*Lumpenus lampetriformis* (Walbaum)
Gunnel	dem.	*Centronotus gunellus* (Linné)
Catfish	dem.	*Anarrhichas lupus,* Linné
Viviparous blenny	viv.	*Zoarces viviparus* (Linné)
Gobies	dem.	*Gobius sp.**
Aphya	dem.	*Aphya pellucida* (Nardo)
Crystallogobius	dem.	*Crystallogobius nilssonii* (M. v. Düben and J. Koren, S: R.)
Dragonets	pel.	*Callionymus sp.**
Lumpsuckers	dem.	*Cyclopterus lumpus,* Linné
Liparids	dem.	*Liparis sp.**
Cod	pel.	*Gadus callarias,* Linné
Haddock	pel.	» *aeglefinus,* Linné
Whiting	pel.	» *merlangus,* Linné
Norway pout	pel.	» *esmarkii,* Nilsson
Rocklings	pel.	*Onos sp.**
Sand-eels	dem.	*Ammodytes sp.**
Long-rough dab	pel.	*Drepanopsetta platessoides,* O. Fabricius
Turbot	pel.	*Bothus maximus,* Linné
Brill	pel.	» *rhombus,* Linné
Scaldfish	pel.	*Arnoglossus laterna* (Walbaum)
Norway topknot	pel.	*Zeugopterus norvegicus,* Günther
Müller's »	pel.	» *punctatus* (Bloch)
Plaice	pel.	*Pleuronectes platessa,* Linné
Flounder	pel.	» *flesus,* Linné
Dab	pel.	» *limanda,* Linné
Soles	pel.	*Solea sp.**

Garfish	dem.	*Belone acus,* Risso
Herring	dem.	*Clupea harengus,* Linné
Sprat	pel.	» *sprattus,* Linné
Pipe-fishes	dem.	*Syngnathus sp.**
»	dem.	*Nerophis sp.**

The young of the following species were taken during the present investigations, but only outside the Skaw:

Weever	pel.	*Trachinus draco,* Linné
Great silver smelt	?	*Argentina silus,* Ascanius.

* The following species of the genera, within which the young have not been determined as to the species, occur as adults in the Danish waters within the Skaw:

Trigla gurnardus, Linné — *T. hirundo,* Bloch

Labrus berggylta, Ascanius — *L. melops,* Linné — *L. rupestris,* Linné, as also some rarer *Labrus* species

Gobius niger Linné — *G. minutus,* Gmelin — *G. ruthensparri,* Euphrasén — *G. microps,* Krøyer — *G. pictus,* Malm

Callionymus lyra, Linné — *C. maculatus,* Rafinesque

Liparis montagui, Donovan — *L. liparis* (Linné) and perhaps *L. barbatus,* Ekstrøm

Onos cimbria (Linné) — *O. mustela* (Linné)

Ammodytes lanceolatus, Lesauvage — *A. lancea,* G. Cuvier

Solea vulgaris, Quensel — *S. lutea* (Risso)

Syngnathus acus, Linné — *S. typhle,* Linné — *S. rostellatus,* Nilsson

Nerophis aequoreus (Linné) — *N. ophidion* (Linné) — *N. lumbriciformis* (Yarrell).

Tab. 1.

Pelagic fish eggs and young in the Danish waters during in 1904.

(All stations in February, March, September and October in the North Sea, Skager Rak and Kattegat were investigated by the »Thor«, the remainder by the »Sallingsund«.)

Day and month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature °C.	Salinity ‰	Pelagic Net. Pelagic fish eggs. Depth in fathoms (approx.)	Duration in min.	Number (approx.)[1]	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	" merlang.	Onos sp.	Drepanops. plat.	Pleuronect. plat.	" flesus	" lim.	Clupea sp.[2]	Number of pelagic fish young of species with demersal eggs. Cottus scorp.	" bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.[2]	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*)
1904. North Sea.																														
$^{26}/_{2}$	Graadyb bell-buoy in NE. $^{1}/_{2}$ N.	8	7	0	1.7						0	20	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	2	1 Clupea sprattus*
											7	20	—	—	—	—	—	—	2	—	—	—	—	—	—	5	—	7	
$^{26}/_{2}$	Graadyb bell-buoy in NE. $^{3}/_{4}$ N.	5	7	0	1.5	31.1					0	15	1	—	—	—	—	—	2	1	—	1	—	—	—	1	—	2	
$^{27}/_{9}$	Vyl lightship in NW. t. N.	13	10	0	14.2						8	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	c. 20 Aphya, 1 Syngnath. rostell.*
$^{28}/_{9}$	Horns Reef light-ship in E.	43	26	0	14.7						40	20	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	4 Trigla sp., 1 Trachinus draco, 2 Crystallogobius, 2 Arnoglossus lat.
1904. Skagerak.																														
$^{17}/_{2}$	Hirshals in ESE	$6^{1}/_{2}$	16	0	2.7	34.0					0	15	—	—	—	—	—	—	8	—	—	—	—	—	—	1	—	c70	
$^{17}/_{2}$	Hirshals in ESE.	18	19	0	3.3	34.3					0	15	2	—	—	—	—	—	7	—	—	—	—	—	—	—	—	c30	
$^{17}/_{2}$	Oxø in NW. $^{1}/_{2}$ N.	31	110	0	3.3	33.0					100	50	—	—	—	—	—	—	c 5	—	—	—	—	—	—	—	—	—	
$^{17}/_{2}$	Oxø in NW. $^{1}/_{2}$ N.	23	225	0	3.7	34.5					225	30	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	1 Crystallogobius
$^{10}/_{3}$	Väderøerne in E. t. N. $^{1}/_{2}$ N.	32	250				0	15	+	Cod, plaice	250	120	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
$^{16}/_{3}$	Skaw lightship in SW. t. W.	5	46	0	0.3		0	30	+	Cod, plaice	40	30	—	—	—	—	—	—	3	—	—	—	1	—	—	—	—	15	
$^{16}/_{3}$	Skaw lightship in SW. t. W.	7	70	0	1.1	25.9	0	15	+	Cod	0	30	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	c25	4 Carelophus asc.
				70	5.4	33.3																							

16/3	Skaw lightship in SSW. 1/2 W.	9	90	65	5.6	34.9	65	20	1	cod.	65	30	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	2			
17/3	Hirshals in S. 3/4 W.	29	130	0	3.4	32.5	130	20	0		0	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1			
											130	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
18/3	Højen in SE. t. E. 3/4 E.	10	40	0	4.8	34.3	0	15	+	cod, plaice, flounder dab																					
				40	5.8	34.6																									
28/4	Skaw lightship in S.	1 1/2	40	0	5.6	28.3	0	5	200	cod, rockling, flounder-dab, sprat	0	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13			
				5	6.6	32.9					10	25	127	6	—	11	31	3	—	c10	—	—	5	—	—	—	6	—	c50	65 Gadus aeglef., 3 Gadus esm.
				40	5.2	35.1					12																			
1/6	Skaw lightship in S.		60	0	11.6	33.4	50	l.	200	rockling, flounder-dab, 1 sole	40	40	19	48	—	25	—	3	92	4	—	—	—	—	—	—	1	—	1	28 Gadus aeglef., 1 Gadus esm.
				20	7.2	34.5					60	20	6	—	—	2	—	—	5	—	—	—	—	—	—	—	2	—	—	
				50	6.3	34.9																									
26/7	Måseskär in E. t. N. 3/4 N.	10	70				0	5	200	sprat, many with o. g., (crustacean eggs)	10	10	—	c50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 Gadus aeglef.,
											40	10	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
											70	30	—	6	—	—	—	—	2	1	—	—	—	—	—	—	—	—	—		
26/7	Skaw lightship in SW. 1/4 W.	4	60				0	5	20	1 flounder-dab, 1 sprat some with o. g.	10	10	—	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9/10	Hirshals in SE. 3/8 S.	42	336	0	11.7	30.3					300	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3 Argentina silus		
14/10	Højens Fyr in SE. t. S.	39	276	0	10.8	26.0					250	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 Argentina silus		
				276	5.5	34.4																									
21/10	Skaw lightship in S. 5/8 E.	29	173	0	10.5						170	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 Crystallogobius		
				173	9.0																										

1904. Kattegat.

16/2	Gilleleje in S.	2	7	0	1.6	22.3					0	15	—	—	—	—	—	—	2	c10	—	1	—	1	—	—	—	c10	2 Carelophus asc.		
16/2	Nakkehoved in S. t. E. 5/8 E.	14	17	0	1.4	22.4					0	15	—	—	—	—	—	—	100	4	—	—	—	3	—	—	—	c10			
16/2	S. f. Store Middelgrund		16	0	1.0	22.4					0	15	—	—	—	—	—	—	10	3	—	—	—	4	—	—	—	5			
17/2	Herthas Flak		16	0	1.3	23.2					0	15	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	1			
5/3	Læsø Rende		8	0	1.0	23.7					9	15	—	—	—	—	—	—	2	16	—	2	—	1	—	—	—	5			
13/3	Aalbæk Bugt		6	0	0.1	24.9	0	30	+	cod, plaice	6	60	—	—	—	—	—	—	5	1	—	2	—	—	—	—	—	3	1 Anarrhichas lup.		
14/3	Hirsholmen in S. t. W. 1/2 W.	2	11								10	30	—	—	—	—	—	—	c10	3	—	—	—	—	—	—	—	—			
16/3	Skaw lightship in WNW.	2	20				0	15	+	cod, plaice	20	30	—	—	—	—	—	—	3	1	—	—	—	—	—	—	—	3			

[1] + under number of pelagic fish eggs indicates that eggs were taken but not counted.
[2] The numbers with three figures under Clupea sp. and Gobiidæ are approximate, c. (ca.) in front of the number is omitted from lack of space.

Tab. 1.

Day and month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature ° C.	Salinity ‰	Pelagic Net. Depth in fathoms (approx.)	Duration in min.	Pelagic fish eggs. Number (approx.)	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	" merlang.	Onos sp.	Drepanops. plat.	Pleuronect plat.	" flesus	" lim.	Number of pelagic fish young of species with demersal eggs. Clupea sp.	Cottus scorp.	" bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*)
1904. Kattegat (continued).																													
21/3	Hirsholmen in S. 1/2 E.	6	8	0	3.0	29.4	0	20	+	cod, plaice, flounder-dab	0	20	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—	
22/3	Trindelen in E.	4	6	0	1.5	22.3	0	15	130	c.100 cod, c. 20 plaice, c. 10 flounder-dab,	0	20	—	—	—	—	—	—	—	10	2	—	—	1	—	—	—	—	5	
22/3	Trindelen in N.	10	35	0	1.4	20.3	0	15	40	c. 10 cod, c. 20 plaice, c. 10 flounder-dab	35	40	—	—	—	—	—	—	—	5	1	—	—	—	—	—	—	—	5	
22/3	Kobbergrunden in WSW.	1 1/2	45	0	1.2	20.8	0	15	+	cod, plaice, 100-200 flounder-dab, long-rough-dab	45	60	1	—	—	—	—	—	—	c15	c10	—	5	—	2	—	—	1	c50	1 Carelophus asc., 1 Anarrhichas lup.
23/3	Hals lightship in NW. t. N.	9	6	0	1.9	22.4	0	15	+	cod, plaice, flounder-dab, long-rough-dab	6	40	—	—	—	—	—	—	—	3	4	—	4	—	2	—	—	—	c10	2 Carelophus asc.
23/3	Hals lightship in SW. t. W.	9	6	0	1.9	20.7	0	15	+	cod, plaice, flounder-long rough dab	5	40	—	—	—	—	—	—	—	4	—	—	1	2	4	—	—	—	c20	
23/3	Læsø Rende lightship in W.	1/2	10	0	2.0	19.7	0	30	+	cod, plaice, flounder dab	10	120	—	—	—	—	—	—	—	5	6	—	6	6	5	—	—	—	c40	2 Carelophus asc.
24/3	Trindelens lightship in W. t. S. 3/4 S.	7	30	0	1.7	20.0	0	15	+	cod, c. 40 plaice, long-rough dab	30	40	—	—	—	—	—	—	—	200	1	—	2	—	1	—	—	—	3	
24/3	Fladens lightship in SE.	3	15	0	1.8	20.5	0	15	+	cod, plaice, flounder-dab	15	40	—	—	—	—	—	—	—	100	2	—	—	—	—	—	—	—	2	
24/3	Anholt light in S. 3/4 E.	13 1/2	7	0	1.7	18.8	0	15	+	cod, plaice, flounder-dab	7	30	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	—	—	2 "Glass" eels, 1 Gobius minut.*, 3 Aphya
25/3	Anholt harbour in E. t. S.	3	4	0	1.6	19.4	0	15	+	cod, c. 100 plaice, flounder-dab	4	90	—	—	—	—	—	—	—	1	18	—	—	—	—	—	—	—	1	
26/3	Kullen in ENE.	3	13	0	2.4	15.4	0	15	+	flounder dab	0	20	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	
				13	4.9	32.8					13	20	—	—	—	—	—	—	—	1	1	—	2	—	1	—	—	—	1	
14/4	Hjælm in NE. t. N. 1/2 N.	5	12	0	4.8	23.5	12	1.	130		0	10	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	c40	
				6	4.9	27.6	0	5	+	cod, 1 rockling	6	10	3	—	—	4	—	—	—	—	1	—	—	—	—	—	—	—	c20	
				12	4.9	30.8					12	10	—	—	—	—	—	—	—	—	—	—	3	—	—	—	1	—	—	2 Crystallogobius
23/4	Off Asaa		2 1/2								0	10	—	—	—	1	—	—	—	8	—	—	—	—	—	—	—	—	—	
23/4	Off Asaa		5								0	10	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—	3 Syngnath. rostell.*
23/4	At Læsø Rendes lightship		12	0	7.0	27.1	12	1.	50		0	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				6	4.8	34.2	0	5	+	flounder dab, 1 haddock	12	20	—	—	—	—	—	—	—	2	2	—	1	—	1	—	1	—	4	
				12	4.8	34.5	6	5	+																						

29/4	Aalbæk in NW.	3	6									6	10	4	—	—	—	11	—	—	c50	—	—	—	—	—	—	3	—	—		
29/4	E. f. Hirsholmen		12	0	5.1	31.7						0	10	—	—	—	—	—	—	—	c20	—	—	—	—	—	—	—	—	—		
				4	4.8	32.9						6	10	—	—	—	—	—	—	—	c20	—	—	—	—	—	—	—	—	—		
				12	4.1	33.9						12	10	2	—	—	—	2	—	—	c20	—	—	—	—	—	—	8	—	—		
30/4	Frederikshavn in WNW.	7	15	0	6.6	30.5						3	10	3	—	—	8	1	7	—	—	—	—	—	—	—	—	—	—	—		
				5	5.3	31.1						10	10	13	—	—	9	1	3	1	c50	—	—	4	—	—	—	16	—	1		
				15	4.9	34.0																										
30/4	Kobbergrundens lightship in SSW.	7	40	5	6.9	27.3	0	10	200	cod, rockling, flounder-dab		4	10	2	—	—	2	1	5	—	c50	—	—	—	—	—	—	—	—	—		
				10	4.4	33.7						11	10	3	—	—	1	—	3	—	c50	—	—	—	—	—	—	—	—	—		
				40	4.8	34.6						40	30	1	—	—	1	—	—	—	—	—	—	1	—	—	—	2	—	—	4 whiting*	
1/5	Anholt light in NW. 3/2 W.	5½	23	0	7.4	23.9	0	5	1000	cod, rockling, flounder-dab		3	10	—	—	—	7	—	3	—	c20	—	—	—	—	—	—	—	—	—		
				10	4.9	31.5						23	30	—	—	—	2	1	3	2	c20	—	—	—	—	1	—	—	—	—		
				23	5.3	34.0																										
2/5	E. f. Sealands Odde		11				0	5	50	cod, rockling, flounder-dab, sprat		11	30	1	—	—	—	—	—	11	—	—	1	—	—	—	2	—	—		
31/5	S.W f. Schultz's Grund lightship		20	0	11.3	13.5	18	1.	119	flounder-dab, sprat, small with o. g.		16	30	1	—	—	2	—	8	14	16	—	—	—	—	—	—	2	—	—		
				5	10.2	21.2						20	10	—	—	—	—	—	2	1	2	—	1	—	—	—	—	53	—	—		
				10	6.8	31.8																										
				18	6.0	32.6																										
31/5	light-buoy on Tangen in SSE.	11	7	0	13.7	17.5	7	1.	74	flounder-dab, sprat, 1 large with o. g.		1	10	—	—	—	1	—	7	13	—	—	—	—	—	—	—	—	1	—		
				7	7.8	29.2						7	10	—	—	1	5	—	9	15	c10	—	—	—	—	—	—	—	—	—		
31/5	Frederikshavn in NW.	8	15	0	13.2	24.4	15	1.	82	flounder dab, 2 sprat, 1Callionymus, 2large with o. g.		12	30	2	2	—	4	—	7	23	—	—	—	—	—	2	—	2	—	—	3 Crystallogobius 4 Aphya	
				5	10.8	25.8						15	10	2	—	—	3	—	1	—	—	—	—	1	—	—	—	1	—	—	4 whiting*	
				15	6.8	33.8																										
1/6	Off Aalbæk		2-4									2-4	25	—	—	—	—	—	4	—	100	—	2	—	—	1	—	2	—	—	11 bottom-stages of plaice	
1/6	Off Aalbæk		4-5									4-5	10	—	—	—	—	—	2	—	—	—	1	—	—	—	—	1	—	—	1 Aphya	
2/6	Nordre Rønner in S.	6	22									20	15	—	1	—	3	—	—	10	—	—	—	—	—	—	—	2	—	—		
3/6	E. f. Flynder-grunden		40	0	13.8	21.6	40	1.	50	1 rockling, flounder-dab, sprat		0	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
				10	8.2	32.8						35	100	15	—	—	72	—	3	230	5	—	3	—	—	—	—	18	—	—		
				40	5.9	34.6						40	15	1	—	—	4	—	—	—	—	—	—	—	—	—	—	1	—	—	2 whiting* 3 Gadus esm	
4/6	Anholt light in NW. t. N.	6	21	0	13.7	19.9	21	1.	60	flounder-dab, sprat, Mackerel, (half the total), 8 Callionymus		18	30	4	—	—	46	1	9	11	5	—	—	1	—	2	—	8	—	—		
				7	10.0	23.5						21	10	1	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—		
				15	5.4	33.1																										
				21	5.4	33.8																										
6/6	Hesselø in WNW.	6	10									9	30	8	—	1	10	—	8	45	1	—	—	—	—	—	—	1	1	—	1 Gadus esm.	
6/6	Kullen in E. 1/2 S.	12	15	0	15.6	17.4	15	1.	47	flounder dab, sprat, rockling, Mackerel																						
				15	5.3	34.0																										

Tab. 1.

Day and month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature ° C.	Salinity ‰	Pelagic Net. Depth in fathoms (approx.)	Duration in min.	Pelagic fish eggs. Number (approx.)	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	„ merlang.	Onos sp.	Drepanops. plat.	Pleuronect. plat.	„ flesus	„ lim.	Clupea sp.	Number of pelagic fish young of species with demersal eggs. Cottus scorp	„ bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*)
1904. Kattegat (continued).																														
11/7	At Schultz's Grund lightship		20	0	15.6	21.6	20	l.	73	flounder-dab, sprat, 3 large with o. g.	10	20	—	—	—	—	—	—	5	—	-	—	—	—	—	—	—	—	—	
				10	7.6	32.5					20	10	—	—	1	—	—	—	3	1	—	—	—	—	—	c20	4	—	—	1 Turbot
				20	7.5	33.4																								
12/7	Grenaa harbour in WSW.	11	9								9	10	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	3 Sole
12/7	Anholt Sønderhjærg in NE.	9½	11								11	10	—	—	—	—	—	—	2	—	—	—	—	—	—	c20	—	—	—	4 Sole
12/7	Anholt light in NW. t. W.	5⅓	21	0	16.6	23.7	21	l.	85	c. 15 flounder-dab, sprat, c. 15 Callionymus, Mackerel	0	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				10	14.4	24.3					10	20	—	4	—	—	—	—	4	6	—	—	—	—	—	c10	—	—	—	1 Mackerel, 3 Labrus
				21	6.6	33.4					15	10	—	1	2	—	—	—	20	2	—	—	—	—	—	—	—	—	—	1 Zeugopt. norveg., 2 whiting*
13/7	Trekosten on Anholt NW. Reef in NE	2	9																							1	1	—	—	1 Mackerel, 1 Labrus
			10								21	20	—	—	—	—	—	—	4	—	—	—	—	—	—	c10	—	—	—	
											9	10	—	1	—	—	—	—	4	1	—	—	—	—	—					
13/7	Trekosten on Anholt NW. Reef in E. t. N.										5	10	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3 whiting bottom-stages
											10	20	—	1	—	—	—	—	33	—	—	—	—	—	—	100	—	—	—	2 Zeugopt. punct., 10 Sole, 1 Callionymus, 1 Mackerel
13/7	Als Kirke in WNW.	12	6-7								6-7	10	—	—	—	—	—	—	23	c20	—	—	—	—	—	100	—	—	—	17 Sole
14/7	Frederikshavn in WNW.	5	12								9	20	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
26/7	Skaw light in N. t. W.	2½	10								10	10	—	1	—	—	—	—	2	—	—	—	—	—	—	c20	—	—	—	8 Crystallogobius
27/7	Hirsholmen in SE.		6								6	10	—	—	—	—	—	—	8	—	—	—	—	—	—	100	—	—	—	1 Zeugopt. norv.
27/7	Nordre Rønner in S.	7	22								22	10	—	2	—	—	—	—	—	—	-	—	—	—	—	—	—	-	—	
27/7	Hirsholmen in WNW.	4	15								15	10	—	2	—	—	—	—	—	—	—	—	—	—	—	c10	—	-	-	
27/7	E. f. Deget		5-8								5-8	10	—	94	—	—	—	—	—	—	—	—	—	—	—	c10	—	c5	—	
28/7	Anholt in SE.	13	7				4	10	40	all with o. g. and large	4	10	—	2	1	—	—	—	—	c5	—	—	—	—	—	—	—	1	—	9 Arnoglossus, 8 Labrus, 8 Mackerel
28/7	Anholt light in NW. t. W.	5⅓	22				0	5	11	10 with o. g.	3	10	—	2	1	—	—	—	—	3	—	—	—	—	—	2	—	—	—	1 Labrus
											15	14	—	5	—	—	—	—	25	4	—	—	—	—	—	2	—	—	—	1 Labr., 2 Callionym.

29/7	NE. f. Gniben		12				0	5	0		10	10	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 Pipe-fish
											12	10	—	—	—	—	—	8	—	—	—	—	—	—	2	—	—	—	1 Crystallogobius, 1 Sole, 1 Labrus
30/7	Ballen in W.1/2N.	3½	14				12	1.	17	15 sprat, 1 with o. g.	10	20	—	—	—	—	—	2	1	—	—	—	—	—	c20	—	1	—	1 Turbot,, 6 Labrus, 2 Callionym.
							8	5	100	Sprat, Callionym., flounder-dab, small with o. g.																			
							13	5	30	as previous haul																			
30/7	Refsnæs light in NE. t. E.1/2E.	6	17				0	5	0		10	10	—	1	—	—	—	7	—	—	—	—	—	—	—	—	—	—	
											17	10	—	2	—	—	—	—	—	—	—	—	—	—	c20	—	—	—	
11/10	Trindelens light-ship in NNE.	2½	18	0	11.9	25.1					16	15	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	16 Aphya, 3 Crystallogobius
13/10	Skagens light-ship in W. 3/4 N.	12	26	0	12.1						26	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 Trigla, 1 Aphya
				26	12.9																								
17/10	Aalbæk Church in W.	2	4	0	11.6						3	60	—	—	—	—	—	—	16	—	—	—	—	—	c10	—	—	—	6 Aphya, 3 Crystallogobius
				4	11.8																								
19/10	Sæby Church in W.	4	7	0	10.6						7	15	—	—	—	—	—	—	8	—	—	—	—	—	—	—	—	—	40 Aphya
				7	11.6																								
19/10	Læsø NW. Reef light in S.	2	17	0	10.3		0	5	0		15	15	—	—	—	—	—	—	8	—	—	—	—	—	—	—	—	—	200 Aphya, 42 bottom stages of whiting
				17	12.0																								
28/10	Kobbergrundens lightship in NW. t. N.	9	c.20	0	9.8		0	10	0																				
29/10	Kullen in SE.t.E.	10	17	0	9.7		0	15	0																				
29/10	Hesselø light in W.1/2 S.	12	15	0	9 8						14	180	—	—	—	—	—	—	c20	—	—	—	—	—	12	—	1	—	8 Aphya
				15	12.5																								

1904. Lim Fjord.

16/4	Løgstør Bredning		4	0	5.7	22.9	0	5	500	Cod	0	10	3	-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
											4	10	2	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	
19/4	Thisted Bredning		6	0	7.4	22.0	0	5	+	Cod, rockling, dab	0	10	1	—	—	—	—	—	—	1	—	—	—	—	9	—	—	2	—	
19/4	Dragstrup Vig		6				0	5	+	Cod, rockling, flounder-dab,																				
19/4	Ved Lavbjærg Hage			0	9.3	26.0	0	5	100	rockling, flounder-dab																				
20/4	Venø Bugt		3				0	5	20	rockling, flounder-dab	0	10	-	—	—	—	-	—	—	2	2	—	—	—	9	—	—	3	2	c. 5 Zoarces
											3	10		—	—	-	—	—	-	1	1	—	—	—	4	—	—	-	—	
22/4	Off Næsby Hage (Løgstør Bredn.)		3				0	5	+	Cod, rockling, flounder dab	0	10	1	—	—	—	—	—	—	4	—	—	—	—	10	—	—	—	2	
											3	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Some sticklebacks*

Tab. 1.

Day and month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature °C.	Salinity ‰	Pelagic Net. Depth in fathoms (approx.)	Duration in min.	Pelagic fish eggs. Number (approx.)	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	merlang.	Onos sp.	Drepanops. plat.	Pleuronect. plat.	flesus	lim.	Number of pelagic fish young of species with demersal eggs. Clupea sp.	Cottus scorp.	bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*).
1904. Lim Fjord (cont.).																														
19/7	Nissum Bredn., eastern part		3½	0	17.3	32.6	3½	l.	3	sprat	0	10	-	-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
											3½	10	—	—	-	—	—	—	—	c50	—	—	-	-	—	c5	-	—	—	
19/7	E. f. Lavbjærg Hage		2				0	5	15	14 sprat, 1 sole																				
20/7	NNE. f. Ferker Odde (Livø Bredning)		4½	0	17.3	25.6	0	5	100	all sprat	3	10	—	—	—	—	—	—	—	c20	—	—	—	—	—	c10	—	—	—	1 pipe-fish
											4½	10	—	—	—	—	—	—	—	100	—	—	—	—	—	c20	—	—	—	2 sole
21/7	Løgstør Grunde		3½								3½	10	-	—	—	—	—	—	—	c20	—	—	—	—	—	c10	—	-	—	
1904. The Sound.																														
7/6	N. f. Hveen revolving light		15	0	14.6	11.0	15	l.	15	flounder-dab, sprat	12	30	1	—	—	3	—	10	112	c50	1	3	1	—	—	—	2	—	—	
				5	12.7	16.8																								
				10	5.8																									
				15	5.8	31.7																								
1904. Great Belt.																														
11/1	SE. f. Sprogø		20	0	1.9	13.7	0	5	0		5	10	—	—	—	—	—	—	—	c50	—	—	—	—	—	—	—	—	c50	
				10	6.4	27.5	10	10	100	plaice	10	10	—	—	—	—	—	—	—	c50	—	—	2	—	—	—	—	—	c50	
				20	7.6	29.0																								
17/3	SE. f. Sprogø		21	0	0.9	16.9	21	l.	45	cod, rockling, plaice	5	10	—	—	—	—	—	—	—	1	c30	—	c5	c30	—	—	—	—	c50	
				10	2.0	24.0	0	5	5		10	10	—	—	—	—	—	—	—	c10	c10	—	c20	c30	—	—	—	—	c50	
				21	2.9	27.5	10	5	1000		21	10	—	—	—	—	1	—	—	1	—	—	c 5	—	—	—	—	—	c10	1 Crystallogobius
25/3	W. f. Vresen		8	0	2.2	17.2					2	12	1	—	1	—	1	—	—	c20	c20	—	c10	c20	c20	—	c 5	—	c20	
13/4	SE. f. Sprogø		22	0	5.1	22.3	22	l.	130		0	10	1	—	—	3	—	—	—	—	1	—	—	—	—	—	—	—	2	
				5	4.6	24.5	0	5	800	cod	5	10	1	—	—	2	—	—	—	1	—	—	2	1	—	—	—	—	10	
				10	4.9	29.5					22	10	—	—	—	—	—	—	—	2	1	—	1	—	1	—	8	—	—	
				22	5.2	32.2																								
18/4	SW. f. Elefantgr.										0	20	—	—	—	7	—	—	—	—	2	—	—	—	—	—	—	—	c20	

4/5	SE. f. Sprogø		24	0	7.8	19.0	24	l.	24	flounder-dab. sprat	24	30	2	—	—	—	—	—	—	9	—	—	2	—	—	—	3	—	—	
				5	6.8	25.0	6	5	1000	cod, rockling, plaice																				
				10	5.7	31.4				flounder-dab, sprat																				
				24	5.8	32.1																								
4/5	Franke Klint in SW. t. W.		4½	11							4½	10	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
4/5	E. f. N. point of Langeland		20								10	10	5	—	—	1	2	—	—	c10	—	—	—		—	—	3		—	
4/5	Fakkebjærg light in NW.t.N.½N.	4	12	0	8.0	19.1	12	l.	39	cod, rockling,	0	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				6	7.8	21.1				flounder-dab	10	20	—	—	—	—	5	—	1	—	—	—	—	—	—	—	—	—	2	
				12	7.0	22.1	0	5	200	cod, rockling, flounder-dab, sprat	12	10	1	—	—	—		—	—		—	—	—	—	—	1	—	—	
							11	10	1000	as previous haul																				
19/5	Off Kerteminde		2								2	70	—		—	—	7	10	—	—	—	—	—	—	—		c5	—	—	many adult fishes
24/5	SE. f. Sprogø		19	0	9.5	16.1	15	5	400	a few rockling,	19	30	c40	—	—	1	—	8	3	100	—	3	—	—	—	2	c70	—	—	
				10	9.6	18.2				flounder-dab, sprat																				
				19	6.9	30.3																								
26/5	Off Holckenhavn		5								4	10	1	—		—	—	—		5	—	—	—	—	—	—	—	—	—	
26/5	Off Knudshoved		8-10	0	9.9	14.7					6	35	2	—	1	—	—	6	6	c20	—	2	—	—		—	1	—	1	
27/5	SE. f. Sprogø		20	0	10.1	12.6	20	l	45	a few rockling,	10	30	3	—		—	3		5	—		—	—	—	—	1	—	—	
				10	10.0	15.3				flounder-dab, sprat	16	10	2	—		—	10	1	240	—	—	—	—	—	—	c20	1	—	
				15	7.5	29.9	15	5	70	as previous haul, also																				
				20	7.1	29.9				1 Callionymus																				
20/6	Off Hverringe Skov		4-7								2	10	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
20/6	Off Kerteminde		1-2								1-2	20	—	—	—		—	1	—	—	—	—	—	—	—	c10	—	1	—	1 Aphya
20/6	Off Nordenhuse		11	0	14.4	15.9	11	l.	100	flounder-dab, sprat	5	20	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				11	9.3	27.7					9	10	—	—	—	—	—	—	68	c20	—	—	—	—	—	—	—	—	—	
											11	10	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1 brill
28/6	Spodsbjærg in NW. t. N.		1½	14	0	12.9	21.3	14	l.	26	flounder-dab, sprat	9	25	—	1	—	—	—	—	12	c30	—	—	—	—	—	c10	—	—	—	1 turbot
				14	9.4	27.9					14	10	—	—	—	—	—	—	5	c20	—	1	—	—	—	—	5	—	—	
29/6	W. f. Albuen		7								7	10	—	—	—	1	—	—	2	—	—			—		—	—	—	—	1 Aphya
11/7	Off Nordenhuse		11	0	14.6	20.5	11	l.	84	flounder-dab, sprat,	0	10	—	—			—	—		—		—	—				—	—	—	
				11	9.2	29.0				1 large with o. g.	8	20	—	—	1	—	—	—	4	2	—	—	—	—	—	1	—	—	—	1 Mackerel, 1 pipe fish
											11	10	—	—	—	—		—	9	5	—	—	—		—	—				1 pipe-fish
8/8	N. f. Stokkebæks-kosten		7	0	18.0	18.1					3	10	—		—			—	2	1	—	—	—	—	—	3	—		—	2 pipe-fish
26/8	Tranekær light in NNW.		20	0	16.5	16.4	5	5	0		10	15	—	—	—	—	—	—	6	1	—	—	—	—	—	3	—	—	—	1 Callionymus
											20	10	—	—	—	—	—	—	3	—	—	—		—		c30	—	—		
1/9	S. f. Sprogø		11								10	10	—	—	1	—	—	—	1	1	—	—	—	—	—	1	—	—	—	

Tab. 1.

Day and month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature ° C.	Salinity ‰	Pelagic Net. Depth in fathoms (approx.)	Duration in min.	Pelagic fish eggs. Number (approx)	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	» merlang.	Onos sp.	Drepanops. plat.	Pleuronect. plat.	» flesus	» lim.	Clupea sp.	Number of pelagic fish young of species with demersal eggs. Cottus scorp.	» bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*)
1904. Little Belt.																														
18/5	Baaring Vig		9	0	9.5	23.8	9	1.	60		7	10	6	—	—	1	—	15	—	13	—	—	—	—	—	—	—	—	—	
				8	7.4	28.5	5	5	500	rockling, flounder-dab, sprat	9	10	6	—	—	4	5	20	8	30	—	—	—	—	1	—	17	—	—	
14/6	N. f. Fænø Kalv		28								5	10	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	
											10	10	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
											15	30	4	—	1	—	—	—	2	c20	—	1	—	—	—	17	—	—	—	
14/6	Baaring Vig		9	0	18.7	17.4	7	1.	12	11 sprat	3	10	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				7	13.8	21.2					6	10	4	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	
											7	20	1	—	1	—	—	—	—	c10	—	—	—	—	—	2	—	—	—	
15/6	S. f. Endelave	2½	14	0	16.9	17.0	14	1.	250	flounder-dab, sprat, 1 sole	4	10	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				7	9.5	27.9					10	20	3	—	—	—	—	—	35	c50	—	1	—	—	—	—	1	—	—	
				14	7.6	30.3					14	10	—	—	—	—	—	—	5	c20	—	—	—	—	—	1	1	—	—	
18/6	Einsiedelsborg in SW.	6	13	0	14.6	17.9	13	1.	200	flounder-dab, sprat, 1 large with o. gs.	5	10	2	—	1	—	—	—	1	—	—	—	—	—	—	2	—	—	—	
				13	8.4	29.5					10	10	—	—	1	—	—	—	44	c30	—	1	—	—	—	2	1	—	—	
							9	5	2000	flounder-dab, sprat, 1 sole	13	10	—	—	—	—	—	—	7	—	—	—	—	—	—	4	-	—	—	
18/8	Mosvig		7								2	10	—	—	—	—	—	—	—	c30	—	—	—	—	—	2	—	—	—	
	Baaring Vig		7								7	10	—	—	—	—	—	—	—	c30	—	—	—	—	—	—	—	—	—	
12/10																														2 bottom-stages of whiting
1904. Western Baltic.																														
22/3	Staber Huk (Fehmarn) in W. t. S. ½ S.	8	14	0	2.2	13.1	14	1.	20	1 rockling, 17 plaice	0	10	—	—	—	—	—	—	—	1	3	—	—	2	—	—	—	—	—	
				4	1.5	15.4	0	5	0		6	10	1	—	—	—	1	—	—	8	15	—	11	56	4	—	1	—	62	
				8	1.4	16.2	4	5	4	plaice	10	10	—	—	—	—	—	—	—	—	4	—	2	16	4	—	1	—	9	
				14	1.4	16.5	13	10	200		14	10	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	
22/3	Markedsdorf (Fehmarn) in S. ½ W.	4½	20	0	3.3	11.5	20	1.	27		0	10	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	2	
				10	1.9	16.7					6	10	—	—	—	—	—	—	—	—	7	—	7	8	—	—	1	—	18	
				20	1.9	21.2																								
23/3	Skjoldnæs (Ærø) in NE.		19	0	2.5	13.4	19	1.	19		0	10	—	—	—	—	—	—	—	2	8	—	—	1	—	—	—	1	152	
				10	1.6	17.4	0	5	4	2 rockling,	10	10	—	—	—	—	—	—	—	1	35	—	3	32	2	—	2	—	29	
				19	1.6	18.7	10	5	300	plaice	19	10	—	—	—	—	—	—	—	—	1	—	1	3	—	—	—	—	2	2 Aphya
							18	10	700																					

6/5	W. f. Skjoldnæs		18	0	7.4	16.1	18	l.	92	eod, rockling, flounder-dab, sprat	3	10	11	—	—	5	14	4	1	2	—	—	—	—	—	—	1	—	3		
				5	7.4	17.5					16	20	5	—	—	—	11	—	—	8	4	—	3	c10	1	—	4	—	2		
				10	5.5	23.1	0	5	100	a few plaice	18	10	3	—	—	—	—	—	—	c10	—	—	—	c20	1	—	2	—	c10	1 Aphya	
				18	4.6	24.5	17	10	1000	c. 10 plaice																				
6/5	N. f. Skjoldnæs		8								8	20	—	—	—	—	1	—	—	—	—	—	—	—	3	—	—	—	1		
6/5	N. f. Søby (Ærø)		14								10	20	—	—	—	—	2	—	—	—	—	—	1	—	—	1	—	—		
17/5	W. f. Skjoldnæs		18	0	9.1	17.7	18	l.	88	cod, rockling, flounder-dab, sprat	15	30	53	—	—	5	31	1	—	1	—	—	—	—	—	—	1	—	1		
				18	5.2	23.6																									
							8	5	400	1 plaice																					
17/5	Off Søby		c.12								12	10	1	—	—	—	8	1	1	—	—	—	—	—	—	—	—	—	—		
30/5	W. f. Skjoldnæs		18	0	12.0	14.0	18	l.	84	rockling, flounder-dab, sprat	15	30	50	—	1	13	9	17	1	1	—	—	—	1	—	—	2	—	—	1 Cyclopt. 5 ctm.*	
				10	8.9	18.9					18	20	8	—	—	4	27	15	—	8	—	—	—	7	1	—	2	—	—		
				18	5.7	23.4																									
10/6	Staber Huk in W. t. N.	11	14	0	13.3	8.8	13	l.	45	flounder-dab, sprat	14	30	18	—	—	—	1	6	24	100	—	—	—	—	—	1	—	—	—		
				8	9.0	20.3																									
				13	7.3	22.0																									
13/6	W. f. Skjoldnæs		18	0	16.7	12.5	18	l.	150	20 flounder-dab, sprat	5	10	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
				10	9.0	21.4					10	20	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
				18	5.8	24.0					16	10	6	—	—	2	1	1	15	c20	—	—	—	—	—	—	—	—	—		
25/6	W. f. Skjoldnæs		19	0	12.8	18.2					4	10	—	—	—	—	—	—	1	—	—	—	—	—	—	c10	—	—	—		
				19	5.8	23.6					15	10	9	—	—	—	—	—	2	1	—	—	—	—	—	—	—	—	—		
											19	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
29/6	Nysted Church in NE.	10	6-7								4	20	5	—	1	—	—	—	2	—	—	—	—	—	—	c10	—	—	—		
											7	5	—	—	—	—	—	—	5	—	—	—	—	—	—	c10			—		
29/6	Nysted church in NE.	12	12	0	13.8	17.1	12	l.	15	flounder-dab, sprat	12	5	2	—	1	—	—	—	11	c10	—	—	—	—	—	c50	—	—	—		
				12	13.3	18.9																									
4/8	W. f. Skjoldnæs		19	0	19.7	11.0	19	l.	30	flounder-dab, sprat, large and small with o. gs.	5	10	—	—	1	—	—	—	1	3	—	—	—	—	—	4	—	—	—		
				10	12.8	21.8					15	20	—	—	1	—	—	—	17	5	—	—	—	—	—	3	—	—	—		
				19	9.5	24.2																									
4/8	W. f. Vorbjærg (Ærø)		20								20	10	—	—	—	—	—	—	1	c50	—	—	—	—	—	c30	—	—	—		
17/8	W. f. Lyø		20	0	17	17.7					15	10	—	—	1	—	—	—	1	c20	—	—	—	—	—	5	—	—	—	1 pipe fish	
				10	16	19.8																									
				20	11	23.3																									
26/8	Staber Huk in W. t. S.	9	14	0	16.0	9.7					10	10	—	—	—	—	—	—	6	c20	—	—	—	—	—	3	—	—	—		
											14	8	—	—	—	—	—	—	1	—	—	—	—	—	—	100	—	—	—	1 bottom- stage of whiting	
27/9	NW. f. Vadrups Flak (Ærø)		18								14	15	—	—	1	—	—	—	—	—	—	—	—	—	—	3	—	—	2		
											18	10	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—		

Tab. 1.

Day and Month.	Place. Bearings.	Distance in miles	Depth in fathoms	Hydrography. Depth in fathoms	Temperature ° C	Salinity ‰	Pelagic Net. Depth in fathoms (approx.)	Duration in min.	Pelagic fish eggs. Number (approx.)	Species.	Young-fish trawl. Depth in fathoms (approx.)	Duration in min.	Number of pelagic fish young of species with pelagic eggs. Gadus call.	" merlang.	Onos sp.	Drepanops. plat.	Pleuronect. plat.	" flesus	" lim.	Clupea sp.	Number of pelagic fish young of species with demersal eggs. Cottus scorp.	" bubal.	Agonus cat.	Lumpenus lamp.	Centronotus gun.	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Other species and older fish (mrkd.*)
1904. True Baltic.																														
$^{14}/_{1}$	Hestehoved in WNW.	4	11	0	1.8	9.2	9	10	50	plaice																				
				5	2.4	9.6																								
				11	3.8	14.9																								
$^{18}/_{3}$	Hestehoved in WNW.	4	12	0	1.4	7.4	12	l.	0		12	10	—	—	—	—	—	—	—	—	3	—	1	6	—	—	1	—	10	
				12	1.6	14.7	11	10	22	1 rockling, plaice																				
$^{19}/_{3}$	Møens light in NW. $^{3}/_{4}$ W.	11	11	0	1.8	7.1	10	10	12	plaice	11	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	
				11	1.6	12.2																								
$^{19}/_{3}$	Høje Møen in WNW.	20	23	0	1.8	7.1	23	l.	15	plaice	2	10	—	—	—	—	—	—	—	—	14	—	1	1	—	—	—	—	24	
				10	1.2	7.9	22	l.	10		10	10	—	—	—	—	—	—	—	1	4	—	—	4	—	—	—	—	16	
				15	1.2	11.2	20	l.	0		23	20	—	—	—	—	—	—	—	1	1	—	1	2	1	—	—	—	1	
				20	2.2	19.7	18	l.	0																					
							22	10	7	plaice, 4 rockling																				
$^{20}/_{3}$	Gedser lightship in WSW.	4	12	0	1.4	7.3	12	l.	3		0	10	—	—	—	—	—	—	—	—	2	—	—	1	—	—	—	—	9	
				6	1.4	12.8	10	l.	2		6	10	—	—	—	—	—	—	—	—	—	—	—	28	—	—	—	—	25	
				12	1.4	16.7	9	l.	0		12	5	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	
							6	l.	0																					
							11	10	100	plaice, long-rough dab																				
$^{8}/_{6}$	S. f. Smyge Huk (Skåne)	8	24	0	12.7	7.2	24	l.	4	sprat	22	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	
				19	7.8	8.1	23	5	16	sprat	24	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	
				24	5.8	12.2																								
$^{9}/_{6}$	E. f. Christiansø		53	0	12.0	6.9	50	l.	120	cod (?), rockling, flounder-dab, sprat	53	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				20	4.6	6.9																								
				30	4.6	12.5	30	l.	17	sprat																				
				40	4.3	16.3	20	l.	1	sprat																				
				53	4.8	17.5	20	l.	4	sprat																				
							20	5	19	sprat																				
							52	15	50	cod (?), rockling, flounder-dab, sprat																				
$^{10}/_{6}$	Hestehoved in WNW.	4	12	0	12.5	7.8	12	l.	4	2 flounder-dab, 2 sprat	12	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3 bottom-stages of cod
				6	12.4	8.1	11	10	200	rockling, flounder-dab, sprat																				
				12	8.0	20.4																								

| | | |

Tab. 3. **Pelagic fish young** in the Danish waters during **1903** and **1904 (Summary).**

(All stations in March, April, September and November 1903 in the North Sea, Skagerak, Kattegat (except one) and Sound, and in February, March, September and October 1904 in the North Sea, Skagerak and Kattegat were investigated by the »Thor«, the remainder by the »Sallingsund«.)

Month.	Region.	Young-fish trawl																																						
		No. of hauls.	Duration in min.	Number of pelagic fish young[1] of species with pelagic eggs.																						Number of pelagic fish young[1] of species with demersal eggs.															
				Gadus call.	» aeglefin.	» merlang.	» esmark.	Onos sp.	Drepanops. plat.	Bothus max.	» rhomb.	Amoglossus lat.	Zeugopt. norveg.	» punct.	Pleuronect. plat.	» flesus.	» lim.	Solea sp.	Trigla sp.	Scomber scomb.	Labrus sp.	Callionymus sp.	Clupea sp	Cottus scorp.	» bubal.	Agonus cat.	Carelophus asc.	Lumpenus lamp.	Centronotus gun.	Anarrhichas lup	Gobiidae.	Liparis sp.	Cyclopt. lump.	Ammodytes sp.	Syngnathidae.						
A. 1903.																																								
January.	West. Baltic	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
February.	Great Belt	3	30	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	30	6	—	14	—	3	3	—	—	—	—	10	—	—	—	—	—	—
March.	Skagerak	2	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—
	Kattegat	4	55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18	2	—	—	1	—	1	—	—	—	—	9	—	—	—	—	—	—
	Sound	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Great Belt	2	25	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	3	7	—	7	—	6	6	—	—	2	—	12	—	—	—	—	—	—
	True Baltic	2	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	10	—	—	—	10	—	—	—	—	—	200	—	—	—	—	—	—
April.	North Sea	3	45	1	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—	—	—	11	1	—	—	—	—	—	—	—	—	—	12	—	—	—	—	—	—
	Great Belt	1	10	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	—	—	4	—	1	—	—	—	19	—	4	—	—	—	—	—	—
May.	Kattegat	7	85	74	—	—	—	—	21	—	—	—	—	20	61	2	—	—	—	—	—	—	17	—	—	4	—	—	—	—	—	1	—	9	—	—	—	—	—	—
	Sound	5	50	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Great Belt	1	15	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Little Belt	1	15	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	West. Baltic	5	65	12	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	1	2	—	—	—	100	—	—	—	3	—	12	—	—	—	—	—	—
June.	Kattegat	9	120	56	—	1	—	—	20	—	—	—	—	—	7	83	—	—	—	—	—	—	30	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—
	Sound	2	20	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	West. Baltic	1	10	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
July.	True Baltic	2	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14	—	—	—	—	—	—	—	10	—	—	—	—	—	—	—	—	—
August.	Great Belt	4	50	—	—	11	1	4	—	—	—	—	—	—	—	40	—	—	—	1	—	—	30	—	—	—	—	—	—	—	30	—	—	—	—	—	—	—	—	—
Septbr.	North Sea	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Skagerak	1	10	—	—	2	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Kattegat	3	30	—	—	—	—	—	—	—	—	2	—	—	—	4	—	1	—	—	4	—	—	—	—	—	—	—	—	—	10	—	—	2	2	—	—	—	—	—
Octbr.	Great Belt	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—	—	—	—	—	—	10	—	—	—	—	—	—	—	—	—
Novbr.	Skagerak	1	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Kattegat	3	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	49	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—

B. 1904 (Summary of Tab. 1).

January.	Great Belt	2	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100	—	—	2	—	—	—	—	—	—	100	—
February.	North Sea	3	55	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	1	—	1	—	—	—	—	6	—	11	—
	Skagerak	4	110	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	—	—	—	—	—	—	—	1	—	100	—
	Kattegat	4	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100	20	—	1	2	—	8	—	—	—	30	—
March.	Skagerak	6	270	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	4	—	1	—	—	—	40	—
	Kattegat	17	715	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	370	70	—	24	5	9	16	2	—	—	1	150	—
	Great Belt	4	42	1	—	—	—	1	—	—	—	—	—	2	—	—	—	—	—	—	—	30	60	—	40	—	80	20	—	—	5	—	130	—
	West. Baltic	9	90	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	12	76	—	26	—	118	10	—	—	5	1	274	—
	Ttue Baltic	8	85	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	25	—	3	—	42	1	—	—	1	—	90	—
April.	Skagerak	3	35	127	65	6	3	—	11	—	—	—	—	—	31	3	—	—	—	—	—	10	—	—	5	—	—	—	—	—	6	—	60	—
	Kattegat	16	190	32	—	—	—	—	27	—	—	—	—	—	16	18	1	—	—	—	—	270	5	—	9	—	—	1	—	—	31	—	70	—
	Lim Fjord	7	70	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	3	—	—	—	—	40	—	—	—	5	4	—
	Great Belt	4	50	2	—	—	—	—	12	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	3	—	1	1	—	—	8	—	30	—
May.	Kattegat	9	170	6	—	2	—	1	24	—	—	—	—	—	1	40	68	—	—	—	—	—	80	—	2	1	—	—	3	—	—	60	1	—	—
	Great Belt	12	275	60	—	—	—	1	2	—	—	—	—	—	10	42	10	—	—	—	—	—	390	—	5	—	—	—	—	—	2	100	1	3	—
	Little Belt	2	20	12	—	—	—	—	5	—	—	—	—	—	5	35	8	—	—	—	—	—	43	—	—	—	—	—	1	—	—	17	—	—	—
	West. Baltic	9	170	131	—	—	—	1	27	—	—	—	—	—	103	38	3	—	—	—	—	—	30	4	—	3	—	40	6	—	—	13	—	17	—
June.	Skagerak	2	60	25	28	48	1	—	27	—	—	—	—	—	—	3	97	—	—	—	—	—	4	—	—	—	—	—	—	—	—	3	—	1	—
	Kattegat	9	245	29	—	1	4	1	138	—	—	—	—	—	1	26	296	—	—	—	—	—	110	—	6	1	—	—	3	—	—	33	1	—	—
	Sound	1	30	1	—	—	—	—	3	—	—	—	—	—	—	10	112	—	—	—	—	—	50	1	3	1	—	—	—	—	—	2	—	—	—
	Great Belt	8	115	—	—	2	—	1	1	1	1	—	—	—	—	1	88	—	—	—	—	—	70	—	1	—	—	—	—	—	20	5	1	—	—
	Little Belt	12	160	17	—	—	—	5	—	—	—	—	—	—	—	—	94	—	—	—	—	—	130	—	3	—	—	—	—	—	30	3	—	—	—
	West. Baltic	10	130	45	—	—	—	2	2	—	—	—	—	—	2	7	60	—	—	—	—	—	130	—	—	—	—	—	—	—	80	—	—	—	—
	True Baltic	7	120	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	—	10	—	—	—	—	—	—	—	30	6	—	—	—
July.	Skagerak	4	60	—	1	80	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
	Kattegat	26	324	—	—	125	—	5	—	2	—	9	2	2	—	—	152	35	—	11	21	5	40	—	—	—	—	—	—	—	450	5	7	—	1
	Lim Fjord	5	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	190	—	—	—	—	—	—	—	45	—	—	—	1
	Great Belt	3	40	—	—	—	—	1	—	—	—	—	—	—	—	—	13	—	—	1	—	—	7	—	—	—	—	—	—	—	1	—	—	—	2
August.	Great Belt	3	35	—	—	—	—	—	—	—	—	—	—	—	—	—	11	—	—	—	—	1	2	—	—	—	—	—	—	—	40	—	—	—	2
	Little Belt	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	—	—	—	—	—	—	—	2	—	—	—	—
	West. Baltic	6	68	—	—	—	—	3	—	—	—	—	—	—	—	—	27	—	—	—	—	—	100	—	—	—	—	—	—	—	150	—	—	—	1
Septbr.	North Sea	2	60	—	—	—	—	1	—	—	—	2	—	—	—	—	—	—	4	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—
	Great Belt	1	10	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—
	West. Baltic	2	25	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	2	—
	True Baltic	1	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	—	—	—	—
Octbr.	Skagerak	3	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Kattegat	6	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	50	—	—	—	—	—	—	—	20	—	1	—	—
	Little Belt	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	—	—	—	—	—	—	—	—	—	—	—	—

[1] In addition, 1 pelagic young of *Caranx trachurus* was taken in September **1903** both in the Skagerak and Kattegat and 1 pelagic young *Trachinus* of *draco* in September **1904** in the North Sea and 4 pelagic young of *Argentina silus* in October in the Skagerak.

C. G. Joh. Petersen: Om de skalbærende Molluskers Udbredningsforhold i de danske Have indenfor Skagen 1888. 8°. 1162 pg. 2 Kort.

Det videnskabelige Udbytte af Kanonbaaden »Hauch«s Togter i de danske Have indenfor Skagen. 1893. 4°. 464 pg. Atlas i folio.

Indhold: Echinodermata (Petersen), Diatomeer (Cleve), Undersøgelse af nogle Bundprøver (Rørdam), Mollusca (Petersen), Cephalopoda (Posselt), Crustacea malacostraca (Meinert), Hydrografi (Rørdam), Polyzoa (Levinsen), Ascidiæ simplices (Traustedt), Annulata, Hydroidæ, Anthozoa, Porifera (Levinsen), Nogle alm. Resultater (General Results. Engl.) (Petersen).

C. F. Drechsel: Oversigt over vore Saltvandsfiskerier med Kort og Planer. 1890. 4°. 100 pg. Med et Tillæg: »Om Naturforholdene indenfor Skagen« af *C. G. Joh. Petersen*. Med Kort. 4°. 46 pg.

Fiskeri-Beretning for 1888—89, 89—90, 90—91, 91—92, 92—93, 93—94, 94—95, 95—96, 96—97, 97—98, 98—99, 99—1900, 1900—01, 1901—02, 1902—03.

Beretning fra den danske biologiske Station I (1890—91)—XI (1900—1901) findes i de tilsvarende Fiskeri-Beretninger.

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VI. Om Rødspætteyngelens aarlige Indvandring i Limfjorden etc. 1887. 49 pg. 1 Kort. 2 Tabeller.
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